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United States Steel Corporation Number 8 Blast Furnace, Fairfield, Alabama

U.S. Environmental Protection Agency, Atlanta, Ga Region IV

12 May 78

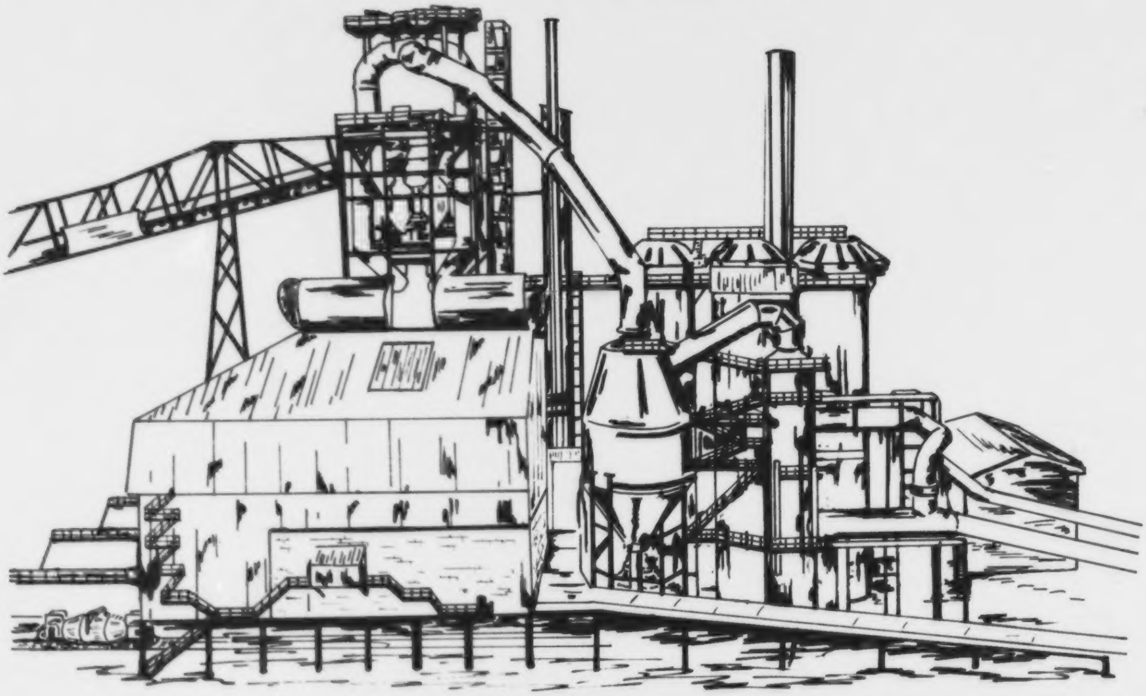
EPA/904-9-78-007

PB 285 264

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

United States Steel Corporation
Number 8 Blast Furnace
Fairfield, Alabama



UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IV
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345 Courtland Street, N.E.
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DRAFT EIS

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16. Abstracts

The United States Steel Corporation has proposed to construct a new blast furnace as part of a modernization program at the Fairfield Works in Jefferson County, Alabama. The iron produced by this unit, estimated to be 1,825,999 tons per year, will enable the company to maintain current production following shut down of antiquated equipment. The draft EIS addresses the existing air quality of Jefferson County Alabama and the existing water quality of Valley Creek and Village Creek, the streams recieving wastewater discarged by U.S. Steel. Modeling of the air emissions and water discharge from the proposed new source predict the potential impacts of the proposed new source.

17. Key Words and Document Analysis. 17a. Descriptors

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Steel Making
Birmingham, Alabama
Valley Creek
Air Quality

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement

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i

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30308

May 12, 1978

TO ALL INTERESTED GOVERNMENTAL AGENCIES, PUBLIC GROUPS
AND CONCERNED INDIVIDUALS

The Draft Environmental Impact Statement (DEIS) for the United States Steel Corporation number eight blast furnace is enclosed for your review and comments. This document has been prepared pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) (Public Law 91-190). A three volume supporting report and technical appendix are also available. These documents comprise EPA's detailed evaluation of the proposed action and contain the supporting data related to the DEIS. Because of the amount of information in the supporting report and technical appendix and recent Council on Environmental Quality directives to reduce paperwork and to make EIS's more readable, the printing and distribution of this material has been limited. These materials may be reviewed at the EPA Region IV Office and at the public libraries in the Birmingham area listed below:

Main Library, 2020 7th Avenue North
Avondale Branch, 509 40th Street
Central Park Branch, 1625 Bessemer Road
East Ensley Branch, 900 14th St., Ensley
East Lake Branch, 5 South 77th Street
Ensley Branch, 1201 25th St., Ensley
Georgia Road Branch, 501 43rd Street
Huffman Branch, 501 Huffman Road
North Birmingham Branch, 3200 27th St. North
Parke Memorial Branch, 1814 11th Avenue South
Pratt City Branch, 820 2nd St., Pratt City
Slossfield Branch, 1916 25th Court North
Smithfield Branch, 18th Avenue West
Southside Branch, 26th Avenue, S.W.
West End Branch, 1241 Tuscaloosa Ave., S.W.
Woodlawn Branch, 5709 1st Avenue North
Wylam Branch, 4300 7th Avenue

EPA has requested review comments and suggestions from the Alabama Air Pollution Control Commission and the Alabama Water Improvement Commission to coordinate the development of the document in conformance with the requirements of the state of Alabama.

A public hearing will be held to discuss this project on June 15, 1978, at 7:00 p.m., in the Engineering Auditorium, Cudworth Hall, at the University of Alabama in Birmingham, 1919 8th Avenue South. Persons wishing to make comments should attend and speak at this hearing. A verbatum transcript will be made of this public hearing. For the accuracy of the record, lengthy or technically complex statements should also be submitted in writing to:

John E. Hagan III
Chief, EIS Branch
EPA, Region IV
345 Courtland St., NE
Atlanta, GA 30308

The applicant has requested an expeditious review to allow issuance of the NPDES permit at the earliest possible date since the facility will be completed and awaiting approval to discharge prior to completion of the NEPA process. EPA requests all agencies to complete their review during the 45 day review period if possible.

The hearing record will remain open and additional written comments may be submitted until June 29, 1978. Such additional comments will be considered as if they had been presented at the public hearing.

Recipients of this document should be aware that EPA will not reprint material contained in the DEIS for the final EIS. The final EIS will consist of the agency's statement of findings, the decision on the new source NPDES permit, any pertinent additional information or evaluations developed since publication of the draft, comments on the project and the agency responses, and the transcript of the public hearing.

Please notify any persons known to you who may be interested in attending the public hearing.

Sincerely,

for John A. Little, Deputy
John C. White
Regional Administrator

Enclosures

EPA 904/9-78-007
NPDES Application Number:
AL0003646

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

for

Proposed Issuance of a New Source National
Pollutant Discharge Elimination System Permit

to

United States Steel Corporation
Number 8 Blast Furnace
Fairfield, Alabama

prepared by

U.S. Environmental Protection Agency
Region IV
Atlanta, Georgia 30308

COLOR ILLUSTRATIONS REPRODUCED
IN BLACK AND WHITE

Approved:

John C. White
Regional Administrator

May 12, 1978
Date

Summary Sheet For Environmental
Impact Statement
Number Eight Blast Furnace
United States Steel Corporation

(X) Draft
( ) Final

U. S. Environmental Protection Agency, Region IV
345 Courtland Street N.E.
Atlanta, Georgia 30308

1. Type of Action: Administrative (X) Legislative ( )

2. Description of Action: The U. S. Steel Corporation is proposing to modernize their facilities at the Fairfield, Alabama plant by addition of the new (No. 8) blast furnace and auxiliaries. Accompanying this action is the installation of a third Q-BOP (variant of the Basic Oxygen Process) furnace, a 57-oven coke battery, 4 additional soaking pits, and the idling of 4 old coke batteries.

These changes at the Fairfield plant will continue existing coking capability and replace existing blast furnace operations at the U. S. Steel Ensley plant. This will also restore the steelmaking capability of the Ensley plant which was lost by shutting down its uncontrolled open hearth furnaces. Moreover, successful operation of the new Fairfield blast furnace will permit the phase-out of three Ensley blast furnaces.

Blast Furnace No. 8 will be located immediately north of existing blast furnace No. 7 at Fairfield operations. Fairfield Works is an integrated steelmaking facility located within Opossum Valley and southwest of the City of Fairfield, Alabama. Fairfield operations cover approximately 5,000 acres. The blast furnace complex area plan will occupy 13.15 acres.

Blast furnace No. 8 will be characteristic of the larger capacity, higher top pressure facilities being constructed by the industry during this decade. The use of beneficiated fuels has increased output as well as assisted control of the process from environmental considerations. The three products of operation--molten iron, slag, and blast furnace gas--are all of value and will be utilized.

Once in operation, the new blast furnace will require a different charge than the older operating units. The new furnace will receive coke, iron ore pellets, sinter and flux. The iron produced by this unit is estimated to be approximately 1,825,000 tons per year, following break-in.

The existing capacity of the Fairfield-Ensley steel-producing complex is 3.5 million ingot tons per year. Implementation of the proposed action would maintain this production capacity.

3. Summary of Environmental Impacts and Adverse Environmental Effects.

(A) Construction

The proposed new No. 8 blast furnace will be constructed on the Fairfield complex immediately north of facilities for blast furnaces No. 5, 6 and 7 which run south to north. Construction impacts are limited to excavating for foundations and earthmoving over approximately 13.15 acres prior to fabrication of the blast furnace. Sedimentation and siltation, due to construction runoff, have been controlled during heavy rains. These impacts have been mitigated by using proper construction practices and by directing all surface runoff through the U. S. Steel Corporation final retention pond for removal of suspended particulates. With construction limited to the existing facility, no impacts to wildlife or vegetation will occur. No archeological or historical sites recorded for the state of Alabama are located on the site of the proposed project.

The new blast furnace will take a minimum of 29 months to construct with a possible manpower peaking period around the twentieth month. Estimated peaking daily manpower requirement will be approximately 1,200 men during construction. The Birmingham SMSA will provide the major percentage of this work force except for certain specialty subcontractors.

(B) Operation

Operation of the proposed No. 8 blast furnace at the Fairfield Works will increase discharges approximately 1 MGD to Valley Creek through Opossum Creek. The proposed action will result in increases of 1.3 lb per day of cyanide, 2.77 lb per day of phenols, 52 lb per day of ammonia and 52 lb per day of total suspended solids loadings to Valley Creek.

Following the break-in period for the new blast furnace, the three remaining blast furnaces at the Ensley Works will be shut down. The proposed action will significantly reduce U. S. Steel Corporation discharges of 13.0 lb per day of cyanides, 1.8 lb per day of phenols, 103 lb per day of NH_3-N and 1668 lb per day of total suspended solids to Village Creek. A reduction of pollutants from improved municipal treatment facilities, together with reduced loadings from the U. S. Steel facilities, may result in some improvement to the backwaters of Bayview Lake.

Overall impacts on water quality will be a net reduction of 8.9 MGD of waste water, 1616 lb per day of total suspended solids, 51 lb per day of NH_3-N, 11.7 lb per day of cyanides and a net increase of 0.97 lb per day of phenols, discharged to the tributaries of Bankhead Reservoir.

Air emissions from the U. S. Steel Complex will improve over pre 1977 operations. The modernization program which includes the new No. 8 blast furnace is the result of a plan to phase out antiquated equipment having high emission rates. The modern replacement facilities will utilize the latest production technology and improved abatement technology which is expected to result in a decrease of emission rates when considering the entire U. S. Steel Complex in the Birmingham area. Even though there will be a reduction in emissions, modeling indicates the air quality standards for particulates will be violated. However, there are inadequacies in the computer model employed as a predictive tool in the air quality investigation. These inadequacies preclude complete acceptance of the modeling results as far as the magnitudes of the predicted concentrations are concerned. An improvement in air quality from the standpoint of total suspended particulates, will result due to the substantially reduced emissions accompanying the modernization program.

Impacts to the biology of the receiving stream are difficult to ascertain since only pollution tolerant organisms have been observed in Opossum Creek and the upper reaches of Valley Creek near the confluence of Opossum Creek. The increased discharges from No. 8 blast furnace to Valley Creek, via Opossum Creek, may extend the area of impact further downstream toward Bankhead Reservoir.

The termination of wastewater discharge from the three remaining blast furnaces at Ensley will contribute to long term biological recovery of Village Creek.

The extractive industry and its attendant activities comprise the major foundation of the economy of Birmingham and Jefferson County, Alabama. Projections of future growth for the Birmingham area by local planners rely heavily on assuming continuing growth of the iron and steel industry. A reduction of 22 employees will occur when the three Ensley blast furnaces are shut down. Additional employment may be generated by other U. S. Steel facilities at the Fairfield Works because of the increased availability of iron at higher production rates from the No. 8 blast furnace and the additional employment required to process this iron into final products for shipment.

4. Alternatives to the Proposed Action:

A. Build or no build
B. Capacity alternatives
C. Site location alternatives
D. Wastewater treatment alternatives
E. Air emission abatement alternatives

5. Federal, State and Local Agencies and Interested Groups Requested to Comment

Federal Agencies

Bureau of Outdoor Recreation
U. S. Coast Guard
Corps of Engineers
Department of Commerce
Department of Energy
Department of Health, Education and Welfare
Department of Interior
Department of Transportation
Department of Housing and Urban Development
Economic Development Administration
Federal Highway Administration
Fisheries and Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey
National Park Service
Office of Federal Activities
Soil Conservation Service

Members of Congress

Honorable John J. Sparkman, United States Senate
Honorable James B. Allen, United States Senate
Honorable John H. Buchanan, United States House of Representatives
Honorable Walter W. Flowers, United States House of Representatives

State

Alabama Air Pollution Control Commission
Alabama Department of Conservation
Alabama Forestry Commission
Alabama Water Improvement Commission
Bureau of Environmental Health
Honorable George Wallace, Governor of Alabama
Robert L. Ellis, Jr., Alabama State Senate
Hugh Boles, Alabama State Representative
Alabama Development Office, State Clearing House, Office of State Planning

Local

Honorable Johnny T. Nichols, Mayor of Fairfield
Neal P. Ellis, Fairfield City Council President
Hoyt Trammell

Interested Groups

Alabama Wildlife Federation
National Audubon Society
Alabama Bass Chapter Federation
Sierra Club
Alabama Environmental Council
Alabama Ornithological Society
Alabama Federation of Women's Clubs

6. This draft EIS was made available to the Office of Federal Activities (OFA) and the public on May 12, 1978.

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1. BACKGROUND

CHAPTER 1

BACKGROUND

1.1. PROJECT DEVELOPMENT

The United States Steel Corporation plans to sustain its iron and steelmaking capacity at Fairfield, Alabama by replacement of certain facilities. Discussions between U. S. Steel Corporation (USSC) and Region IV of the Environmental Protection Agency (EPA) confirmed that an environmental impact statement would be necessary with regard to the proposed activities. EPA determined (see Appendix A) that the new blast furnace would be considered a new source under the National Pollutant Discharge Elimination System (NPDES) Program, and thus be subject to all provisions of the National Environmental Policy Act of 1969 (83 Stat 852). Additionally, EPA determined that all three new facilities--the third Q-BOP furnace, new coke oven, and blast furnace--would be considered new sources under Section 110 of the Clean Air Act.

Subsequently, EPA and USSC selected Associated Water and Air Resources Engineers, Inc. (AWARE, Inc.) under a third party agreement to prepare an environmental impact statement under the direction of the Environmental Protection Agency. This document describes the existing, replacement, and new facilities located at Fairfield Works and the environmental impact of the blast furnace on the environmental baseline.

In the data acquisition, analysis, and evaluation phases of the development of this impact statement, a large amount of information was generated. Practical considerations preclude the inclusion of all the information in this document. Consequently, that information judged to be most pertinent and illustrative has been included in this document and a Technical Support Document (TSD) has been prepared. The TSD and its appendices contain all of the information generated and thus complement and support the evaluations presented herein.

1.2. NEPA OVERVIEW

The authority for the preparation of an EIS as a result of issuance of a new source NPDES permit was summarized in the Federal Register on Tuesday, January 11, 1977, Part V, as follows:

> The National Environmental Policy Act of 1969 (NEPA), 42 USC 4321 et seq implemented by Executive Order 11514 of March 5, 1970 and the Council on Environmental Quality's (CEQ's) Guidelines of August 1, 1973, require that all agencies of the Federal Government prepare detailed environmental statements on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. The object of NEPA is to build into the Agency decision-making process an appropriate and careful consideration of all environmental aspects of proposed actions, explain potential environmental affects of proposed actions and their alternatives for public understanding, avoid or minimize adverse effects of proposed actions, and restore or enhance environmental quality as much as possible.
>
> Section 511(c)(1) of the Federal Water Pollution Control Act as amended (FWPCA) (Pub L 92-500) authorizes the Administrator to apply NEPA to the issuance of a permit under section 402 of the FWPCA for the discharge of any pollutant by a new source as defined in section 308 of the FWPCA. The discharge of a pollutant as defined in section 502(12) of the FWPCA means an addition of any pollutant to navigable waters, the contiguous zone or the ocean from any point source. The Environmental Protection Agency published proposed regulations in the Federal Register (40 FR 47714) on October 9, 1975, entitled "New Source NPDES Permits, Preparation of Environmental Impact Statements."

2. INTRODUCTION

CHAPTER 2

INTRODUCTION

2.1. HISTORICAL AND GEOGRAPHICAL BACKGROUND OF EXISTING FACILITIES

The steel industry originally located in the Birmingham area due to both a diversity and an abundance of the raw materials necessary for the making of iron and steel. These materials could be found within a radius of eight miles of the Fairfield Works site in Opossum Valley. The required minerals include:

1. Abundant deposits of red hematite iron ore (mining was discontinued in 1962).
2. Coal from the Warrior coal fields located to the immediate northwest. These deposits contain coking grade coal necessary for iron making.
3. Abundant dolomite deposits, known as fluxstone, a carbonate rock having a high lime content and being well suited for steel refinement, also located in Jones and Opossum Valleys.

The proximity of these mineral outcroppings attracted many business entrepreneurs to the Birmingham region in the latter part of the 19th century. Many small coal and iron ore mining and coke and iron production facilities sprang up, died, or merged into larger concerns. Colonel Enoch Ensley amalgamated several of these large holdings into a single company in 1886. This he named the Pratt Coal and Iron Company. It was this company which was the forerunner of the present-day U. S. Steel facilities located in the Birmingham area.

The Pratt Coal and Iron Company later became part of the Tennessee Coal, Iron and Railroad Company. The financial panic of 1907 put this company into distress. At the urgings of then President Theodore Roosevelt and various concerned business interests,

U. S. Steel Corporation was persuaded to buy the struggling company on November 1, 1907. From this point on, the company was to be a vital economic factor in the further industrialization and growth of the South.

The company has continued its steady growth since this period, adding and replacing facilities until today it is the South's major steel producer and only fully integrated steel complex.

In 1972, Fairfield Works' open hearth facilities consisted of twelve 225-ton furnaces located at Fairfield, and five 145-ton furnaces located at Ensley. The Fairfield operations were rated at 2.7 million net tons per year and the Ensley operations had a rated capacity of 0.8 million net tons per year. During the first six months of 1971, the two facilities' combined production was at an annual rate of 3.5 million ingot tons.

Several years before air emission standards were promulgated in Alabama, U. S. Steel was engaged in investigations to replace open hearth steelmaking facilities at Fairfield Works with basic oxygen furnaces as a means to achieve compliance with anticipated standards.

About this time, U. S. Steel was investigating a variant of the basic oxygen process (BOP), which became known as Q-BOP. Research demonstrated that the grades of steel produced by Q-BOP would cover the range of Fairfield product mix, including such items as rails, axles, plates, and sheet and tin products. Also, the Q-BOP product was comparable in quality to that produced in the conventional basic oxygen process and open hearths. It was also demonstrated that, compared to the BOP, the Q-BOP process had a potential for improved yields and improved heat time. When it was clear the Q-BOP process was an improved steelmaking technology, it was decided to install large scale Q-BOP steelmaking equipment in the No. 1 open hearth shop. Major facilities consisted of two 200-ton furnaces with auxiliaries, including gas-cleaning equipment. Construction began in July, 1972.

With the construction of the Q-BOP at Fairfield, the elimination of air emissions and problems of obsolescence associated with the open hearth furnaces at Ensley became matters of serious concern for U. S. Steel. Studies were undertaken with the intent of finding a method of meeting pollution control requirements. In October, 1974 a plan was finalized which would idle both blast furnace and uncontrolled open hearth operations at Ensley. This proposal included a third Q-BOP, teeming facilities, new soaking pits, a new coke battery, and a new blast furnace at Fairfield, maintaining the production capability of Fairfield Works at 3.5 million net tons per year.

2.2. CHRONOLOGY OF THE PROPOSED ACTION

The start-up of No. 8 blast furnace is expected to be July 1, 1978, and the break-in period will be approximately 12 months with a maximum of 18 months. One Ensley blast furnace is scheduled to come off January 1, 1979, and all three are scheduled to be off by July 1, 1979. A detailed presentation of the chronology of the proposed action, including an itemized listing of all replacements and expansions of facilities from the inception of Ensley operations in the 1880's, is presented in the Technical Support Document (TSD).

2.3. EXISTING FACILITIES AND SUMMARY OF THE NEW SOURCE FEATURES

Existing Facilities. Fairfield Works, which includes operations at Ensley, Fairfield, and Wenonah, Alabama is the largest and most diversified steelmaking plant in the South. It converts raw materials (iron ore, coal, and limestone) into a broad range of finished and semi-finished steel products designed to serve the growing southern markets. An overall view of U. S. Steel facilities in the Birmingham area is shown in Figures 2-1 and 2-2.

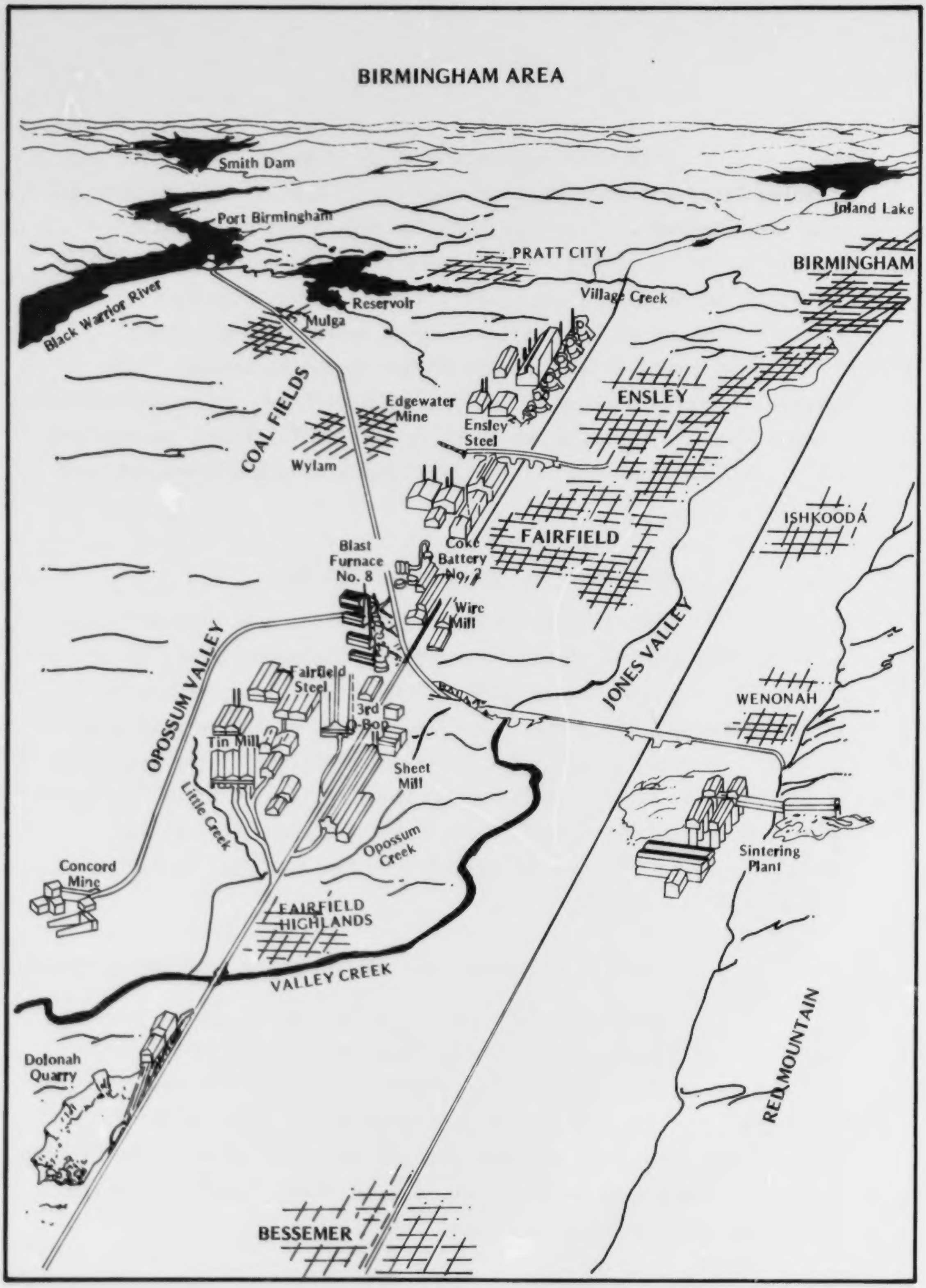
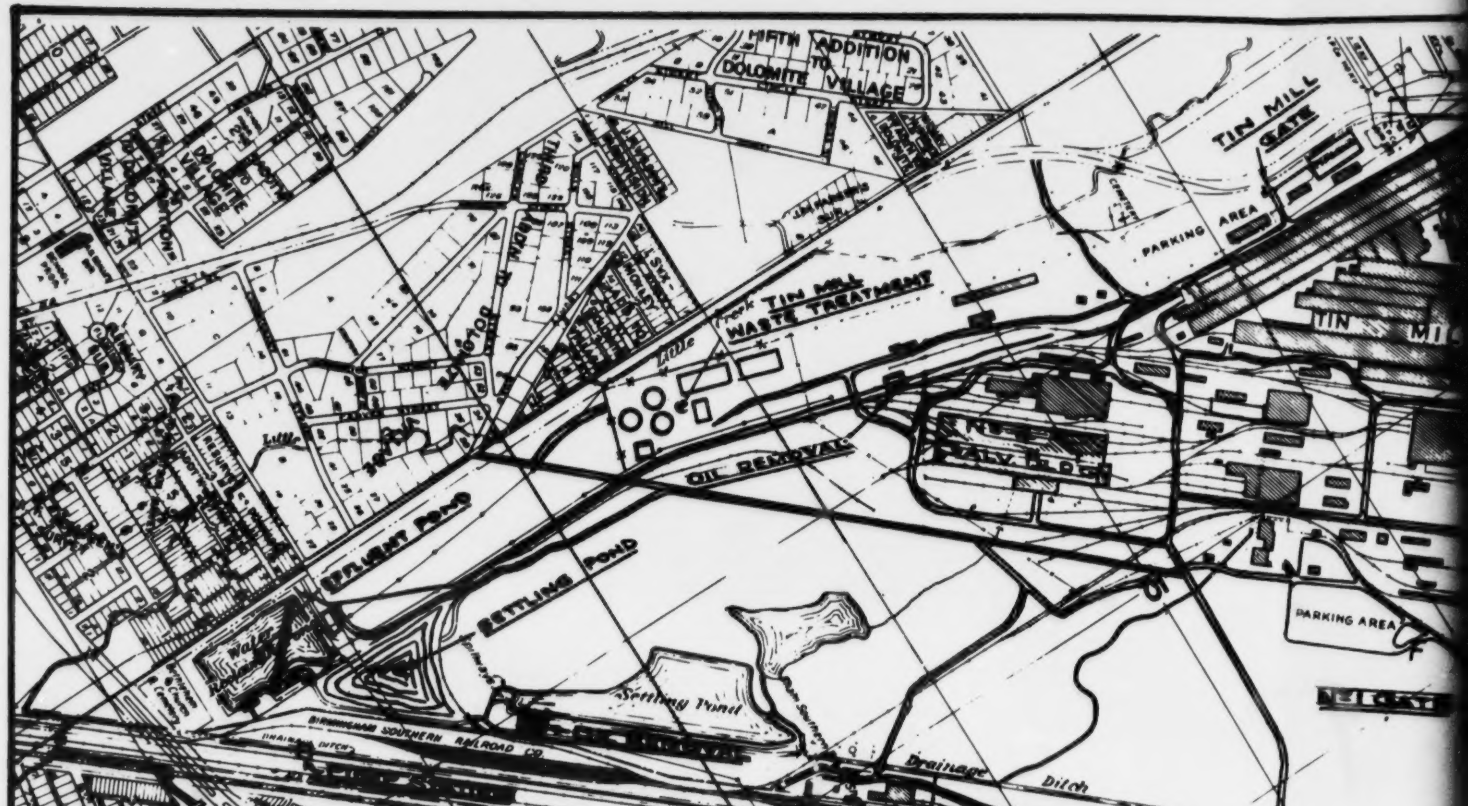
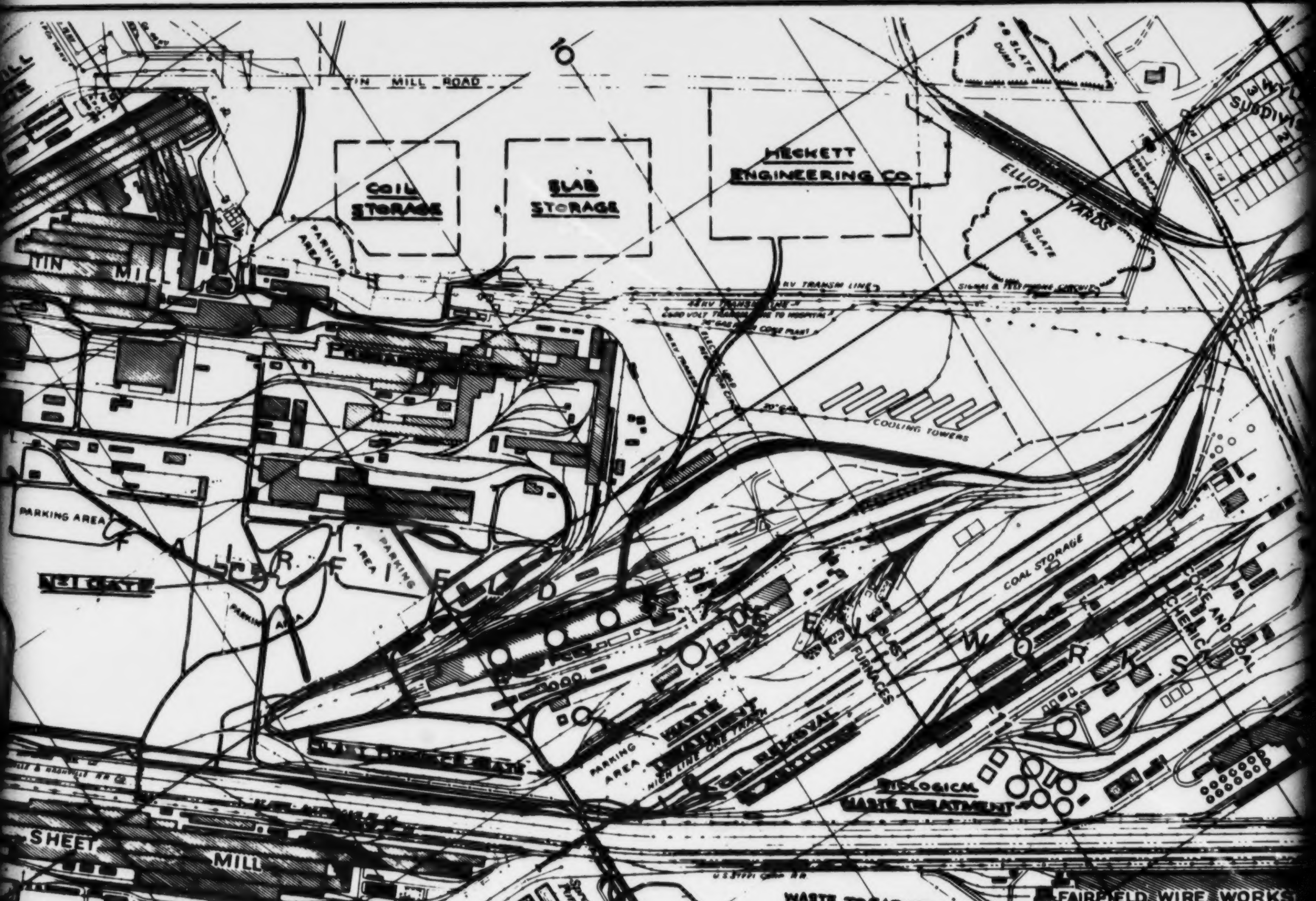

BIRMINGHAM AREA
Smith Dam
Inland Lake
Port Birmingham
PRATT CITY
BIRMINGHAM
Reservoir
Village Creek
Black Warrior River
Mulga
COAL FIELDS
Edgewater Mine
Ensley Steel
ENSLEY
Wylam
ISHKOODA
Blast Furnace No. 8
Coke Battery No. 2
FAIRFIELD
Wire Mill
OPOSSUM VALLEY
JONES VALLEY
Fairfield Steel
3rd Q-Bop
Tin Mill
WENONAH
Sheet Mill
Little Creek
Opossum Creek
Sintering Plant
Concord Mine
FAIRFIELD HIGHLANDS
VALLEY CREEK
RED MOUNTAIN
Dolonah Quarry
BESSEMER

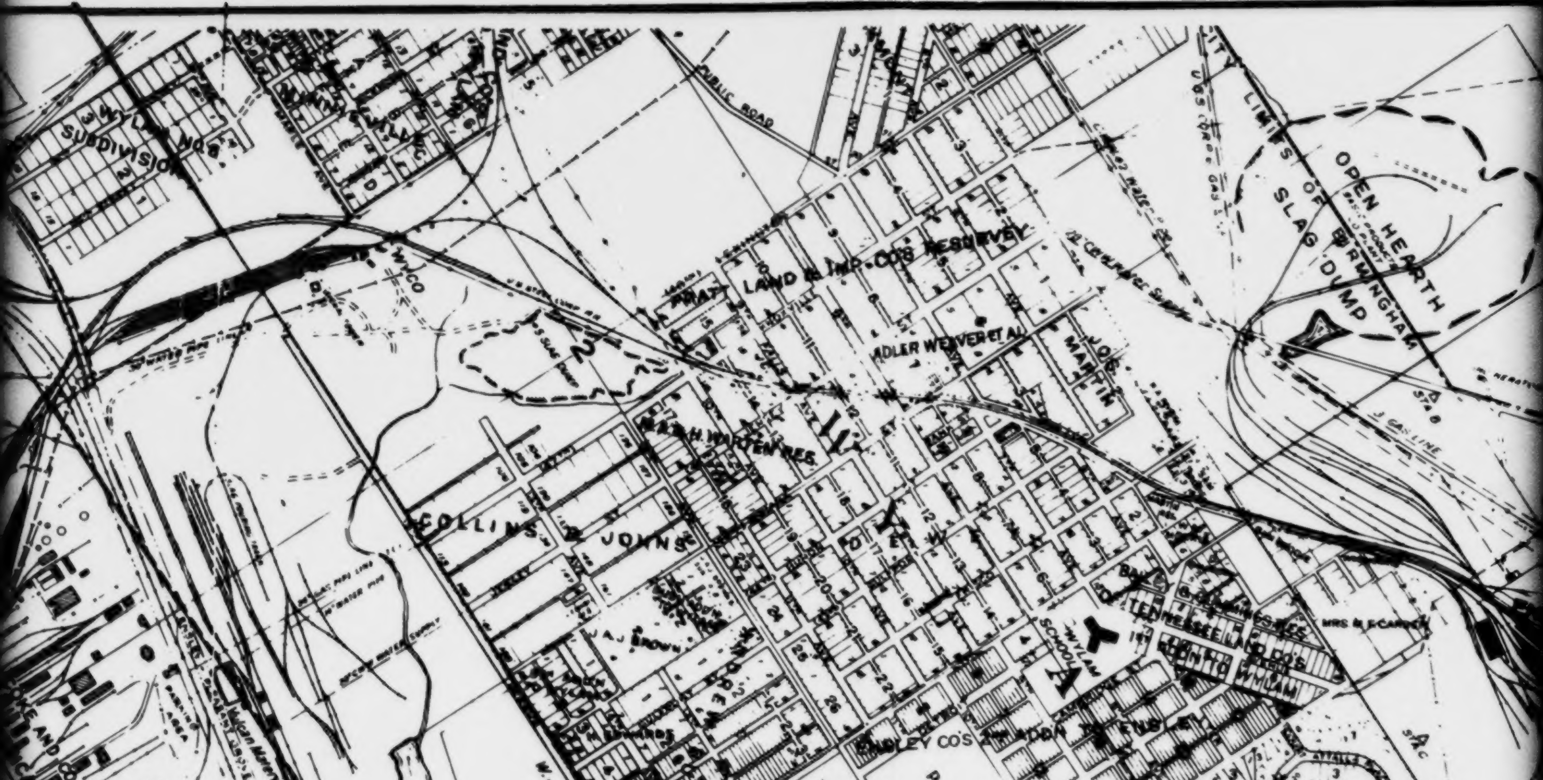
FIG. 2-1 UNITED STATES STEEL OPERATION IN THE BIRMINGHAM AREA


FIFTH ADDITION TO DOLOMITE VILLAGE
TIN MILL GATE
PARKING AREA
Little Creek
TIN MILL WASTE TREATMENT
TIN MI
OIL REMOVAL
EFFLUENT POND
SETTLING POND
Settling Pond
PARKING AREA
BIRMINGHAM SOUTHERN RAILROAD CO.
Drainage Ditch
Diversion Ditch
LOUISVILLE & NASHVILLE R.R. CO.
Settling Pond No 3
Settling Pond No 4
SHEET
RESURVEY OF COREY TERRACE
RESURVEY OF COREY HIGHLANDS
FAIRFIELD HIGHLANDS
2nd ADDN TO FAIRFIELD HIGHLANDS
FLINT RIDGE YARDS

A

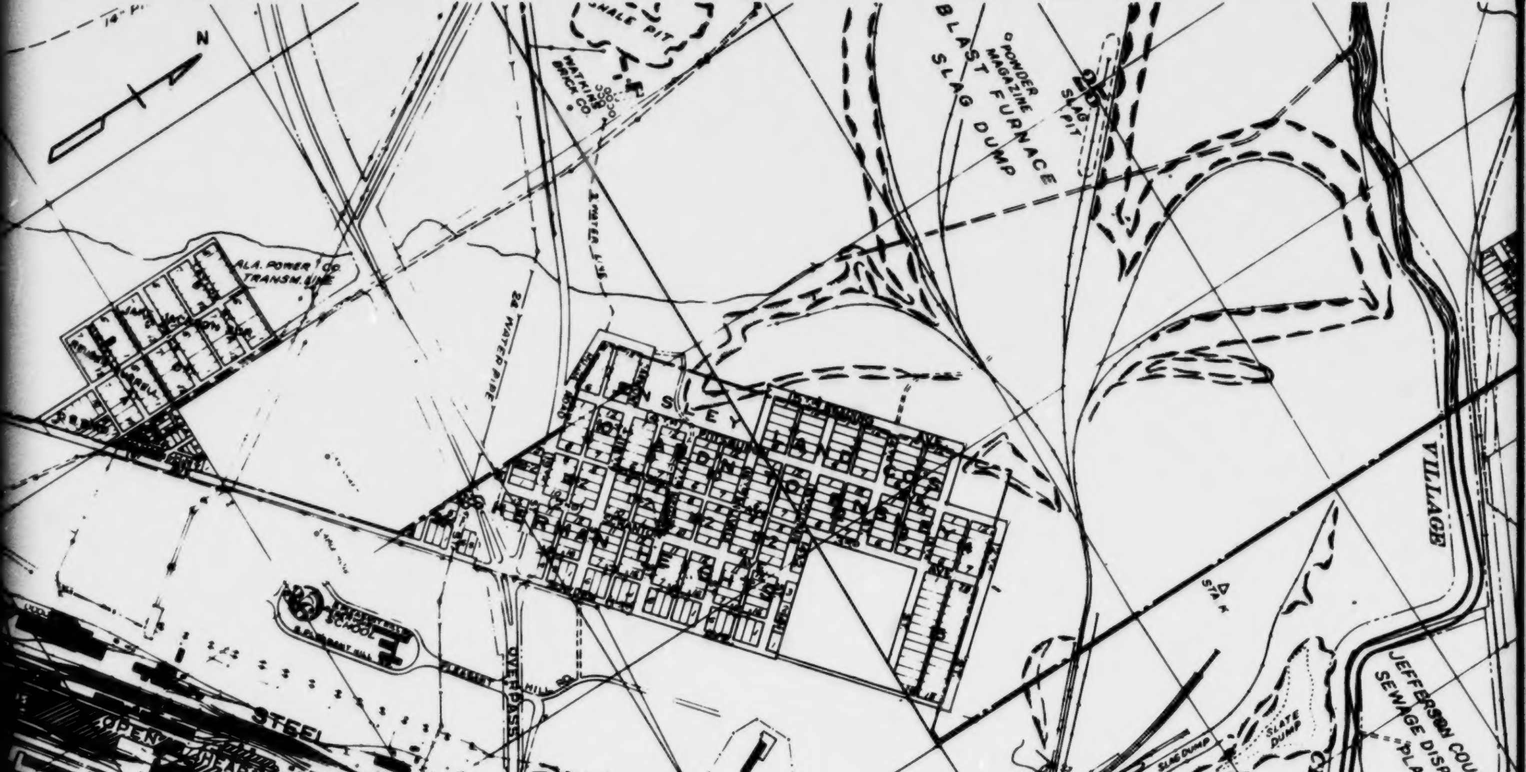

10
TIN MILL ROAD
COIL STORAGE
SLAB STORAGE
HECKETT ENGINEERING CO.
SLATE DUMP
ELLIOT YARDS
SUBDIVISION
TIN MILL
PARKING AREA
COOLING TOWERS
PARKING AREA
FAIRFIELD WORKS
No 1 GATE
PARKING AREA
PARKING AREA
COAL STORAGE
BLAST FURNACES
COKE AND COAL CHEMICALS
PARKING AREA
WASTE TREATMENT
OIL REMOVAL
BIOLOGICAL WASTE TREATMENT
SHEET MILL
WASTE TREATMENT
FAIRFIELD WIRE WORKS
Opossum Valley Creek
OPOSSUM VALLEY ROAD
FLINT RIDGE YARDS

B



WYLAM NO. 3 SUBDIVISION
PUBLIC ROAD
CITY LIMITS OF BIRMINGHAM
OPEN HEARTH SLAG DUMP
PRATT LAND & IMP. CO'S RESURVEY
ADLER WEAVER ET AL
JOB MARTIN
MARY H. WARREN RES.
COLLINS & JOHNS
J. A. J. BROWN
W. J. Bullock, Inc.
THE BARRETT CO.
WYLAM SCHOOL
TENNESSEE LAND CO'S
ENSLEY CO'S
Park
WYLAM HILLS
34th ST. YARDS
W
Y
L
A
M
Harbison-Walker Refractories Co.
WORKS
COMMERCE AVE
COMMERCE AVENUE URBAN RENEWAL AREA
CRAWFORD STREET
GARY AVE
GARY
PARKWAY
FAIRFIELD
FAIRFIELD PARK
ENSLEY DEVELOPMENT CO'S ADD'N
AVENUE

c


N
SHALE PIT
WATKINS BRICK CO.
POWDER MAGAZINE
BLAST FURNACE SLAG DUMP
SLAG PIT
ALA. POWER CO. TRANSM. LINE
24" WATER PIPE
ENSLEY LAND CO.
ENSLEY
ACKERMAN
VILLAGE
SCHOOL
OVERPASS
STEEL WORKS
OPEN HEARTH
RAIL MILL
TREATMENT
BLAST FURNACES
BIRMINGHAM SLAG CO PLANT
SLAG DUMP
SLATE DUMP
CREEK
JEFFERSON COUNTY SEWAGE DISPOSAL PLANT
SLUDGE SETTLING
FOURTH
AVENUE
AVE B
THIRD
ENSLEY
UNITED STATES STEEL CORPORATION
FAIRFIELD WORKS
GENERAL ARRANGEMENT
FAIRFIELD & ENSLEY WORKS
500 250 0 500
SCALE IN FEET
J-13284-S
REVISED 5-4-71

Continuing modernization and expansion programs have enabled Fairfield Works to keep pace with the steel needs of the growing southern economy. The primary iron and steelmaking process is presented in Figure 2-3, as it occurs at Fairfield. Among products produced at Fairfield Works are tin plate and a variety of steel sheets for use in consumer products such as beverage and food containers, appliances and pre-engineered steel buildings, in addition to steel plates and structural shapes for railroad cars and construction applications, rails, and rail accessories.

Iron ore is prepared for use in the blast furnaces at the ore conditioning plant at Wenonah. The larger size ore is used in the blast furnace and the small size, called "fines", is processed into a material suitable for use in the blast furnace. The iron ore "fines" and other iron-bearing material recovered from various operations at Fairfield Works are mixed with coke and limestone and placed on a traveling grate called a sinter machine. The grate containing the "material blend" moves under an ignition furnace (operated at 2,500°F), igniting the coke in the mixture. The heat generated by the burning coke fuses the material into a clinker-like mass, called sinter. The sinter is shipped to the blast furnace.

Iron is extracted from the ore in the blast furnace. The furnace is charged (filled) at the top with measured quantities of iron ore, sinter, or iron-bearing pellets, along with dolomite and coke. Inside the blast furnace, which operates continuously, chemical reactions take place at very high temperatures to produce the molten iron. As the raw materials move downward through the furnace, they react with the hot gases moving upward. Iron is reduced from the iron ore through the combustion of the coke. Air is heated in hot blast stoves (dome-topped cylinders located nearby) to an extremely high temperature. The hot air traveling through the stoves is forced into the blast furnace to aid combustion of the coke.

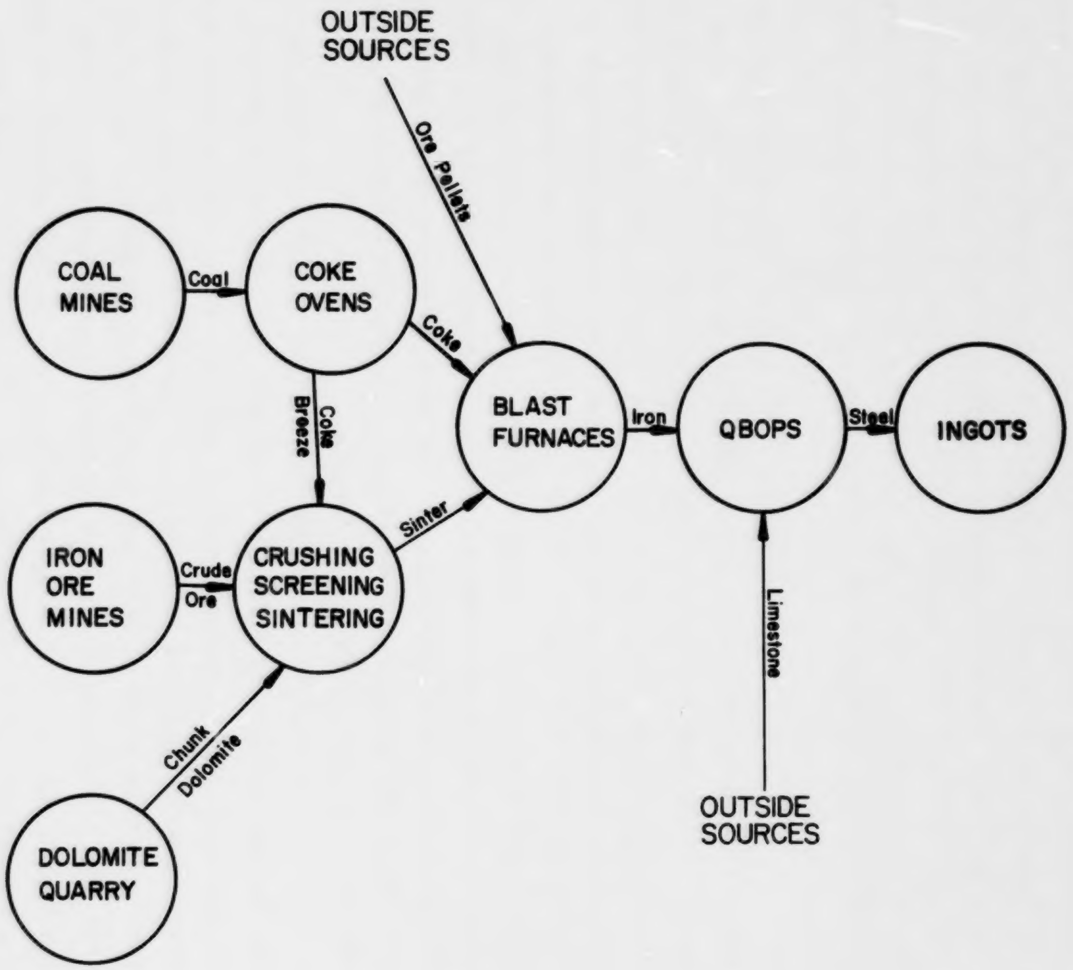

OUTSIDE SOURCES
Ore Pellets
COAL MINES
Coal
COKE OVENS
Coke
Coke Breeze
BLAST FURNACES
Iron
QBOPS
Steel
INGOTS
Sinter
IRON ORE MINES
Crude Ore
CRUSHING SCREENING SINTERING
Chunk Dolomite
DOLOMITE QUARRY
Limestone
OUTSIDE SOURCES

FIG. 2-3. PRIMARY STEELMAKING PROCESSES

As the chemical reactions continue inside the furnace, impurities in the iron ore combine with the dolomite to form slag. Slag and molten iron are drawn off every few hours. Iron is transported in special insulated ladle cars to the steelmaking furnaces.

Gases produced during the process are collected from the top of the furnace, cleaned, and used to heat the air in the hot blast stoves. Blast furnace gas is also burned in the boilers to generate electrical power for other parts of Fairfield Works.

Steel is produced in Q-BOP furnaces. The Q-BOP furnaces are the first of their type in the Western Hemisphere to be built in an existing open hearth steelmaking shop.

In the steelmaking process, molten iron from the blast furnace and recycled scrap steel are charged (fed) into the Q-BOP furnace. These materials are melted and refined by introducing oxygen and flux, which are injected through openings in the bottom. Using the most sophisticated instrumentation available, the furnace can produce a wide range of carbon and alloy steels to satisfy customer requirements.

Particulate matter generated during the steelmaking process is evacuated through a vacuum hood which covers the top of the furnace. The particle-laden gases are quenched and scrubbed with water, and the remaining carbon monoxide gas is converted into carbon dioxide at the top of the flare stack located outside the building. Water used to quench and scrub the gases is processed in a treatment facility located nearby. It passes through a series of treatments including a desilter bowl and clarifier. Sludges are dewatered on a vacuum filter. Eventually, the water is returned for reuse in the gas scrubber system at the Q-BOP.

After the molten iron and scrap in the Q-BOP are processed, usually in about 40 minutes, the furnace is tilted and the 2,800°F molten steel is poured into a ladle. Special alloying elements which can improve hardness or corrosion resistance or alter other properties of the metal are added during the pouring or tapping process. An overhead crane carries the ladle of steel to a "teeming" platform where the metal is tapped from the bottom of the ladle into ingot molds. The steel is allowed to cool and solidify in the molds, which are later removed (stripped). Steel finishing facilities are described in Figure 2-4.

Ingots first go to the semi-finished mills where they are rolled on separate mills into blooms, slabs, and billets. These three semi-finished shapes then go to finishing mills. There they are rolled into the principal finished forms listed below:

1. Structural steel and rails.
2. Plate, sheet, and strip.
3. Rods, bars, and bar flats.

Summary of New Source Features. The new blast furnace at the Fairfield plant will be characteristic of the larger capacity, high top pressure facilities being constructed by the industry during this decade. The use of beneficiated fuels has increased output as well as assisted control of the process for environmental considerations. These three products of operation--molten iron, slag, and blast furnace gas--are all of value and will be utilized.

Once in operation, the new blast furnace will require a different charge than the older operating units. A detailed raw material demand list before and after the installation of the new furnace is presented in Chapter 3. The new furnace will receive coke, iron ore pellets, sinter, and flux. The iron produced by this unit is estimated to be approximately 1,825,000 tons per year, following break-in.

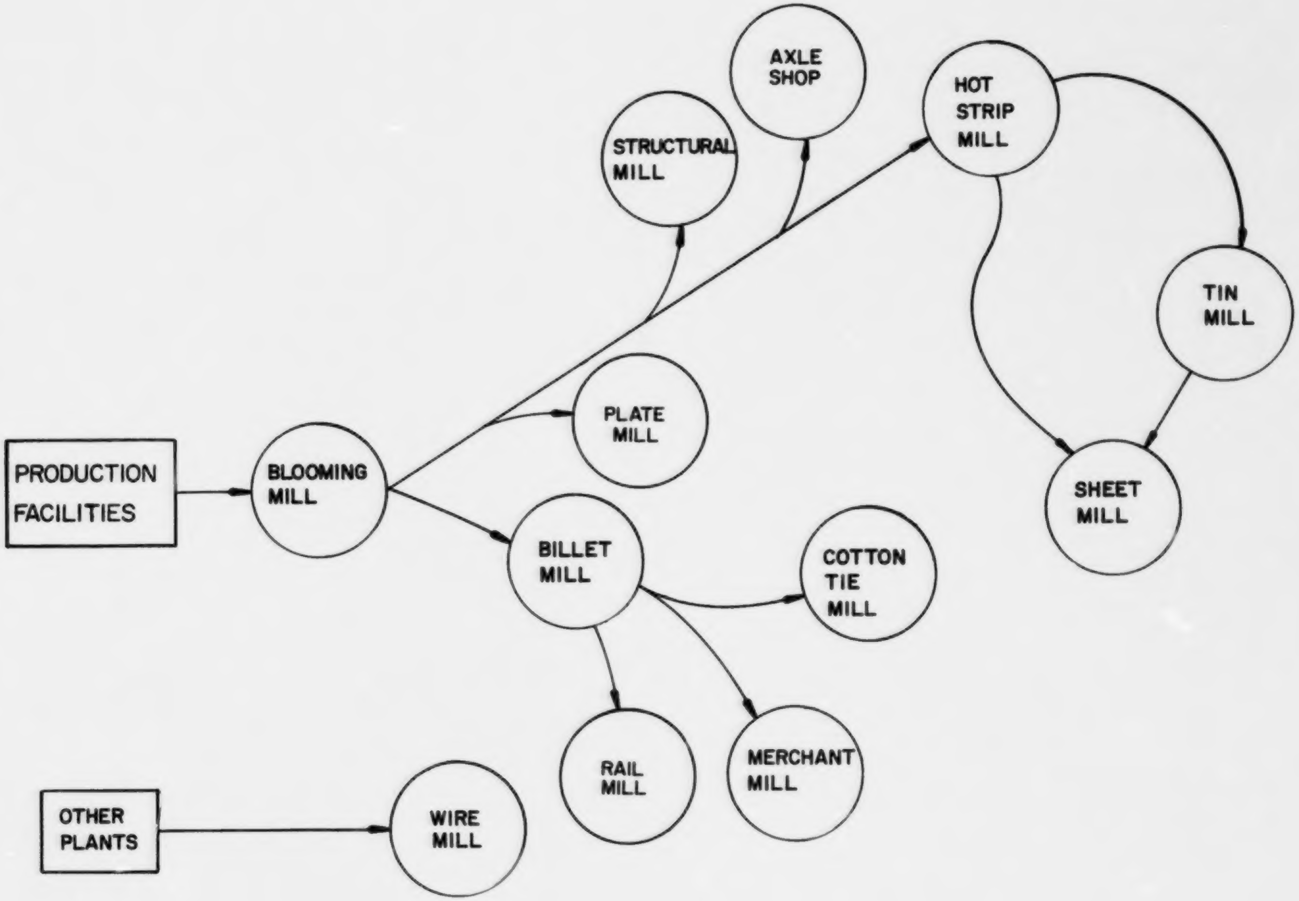

PRODUCTION FACILITIES
BLOOMING MILL
PLATE MILL
STRUCTURAL MILL
AXLE SHOP
HOT STRIP MILL
TIN MILL
SHEET MILL
BILLET MILL
COTTON TIE MILL
RAIL MILL
MERCHANT MILL
OTHER PLANTS
WIRE MILL

FIG. 2-4. FAIRFIELD WORKS STEELFINISHING PROCESSES

3. ENVIRONMENT WITHOUT THE PROPOSED ACTION

CHAPTER 3

ENVIRONMENT WITHOUT THE PROPOSED ACTION

3.1. EXISTING ENVIRONMENT

3.1.1. Existing Facilities at Fairfield Works

A description is presented of those facilities which may influence the environmental baseline or be affected by the blast furnace, including a description of the treatment processes which apply specifically to the control of the wastewaters or air emissions from that process.

After completing the description of the specific processes and related treatment facilities, a description of those additional wastewater treatment facilities which serve more than one process is provided.

During a characteristic period from September, 1975, to December 31, 1975, the following facilities and processes were operable at Fairfield Works:

Wenonah Operations

Sinter plant (4 strands operating)

Fairfield Operations

1. Coke and coal chemicals plant (7 batteries operating)
2. Blast furnaces (3 operating)
3. Q-BOP's (2 vessels)
4. a. Plate mill (primary mill)
   b. Billet mill (finishing mill)
5. Fairfield tin mill
   a. Pickling
   b. Cold rolling
   c. Cleaning
   d. Annealing

    e. Plating
    f. Temper rolling
    g. Side trimmers
6. Merchant mill
7. Cotton tie and hoop mill
8. Structural mill and rail products
9. Steel axles and forge shops
10. Fairfield sheet mill
    a. Shears and trimmers
    b. Cold roll finishing
    c. Annealing
    d. No. 1 continuous galvanizing
    e. No. 2 continuous galvanizing
    f. No. 4 continuous galvanizing
    g. Temper rolling
    h. Coil painting
11. Fairfield wire mill
    a. Wire drawing
    b. Wire annealing
    c. Wire galvanizing
    d. Woven fence
    e. Barbed wire
    f. Welded wire fabric mesh
    g. Nails

Ensley Operations

1. Ensley steel plant
    a. Blast furnaces (3)
    b. Open hearths (3)
    c. Primary mills (including rail mill)
    d. Iron foundry
2. Rail transportation shop
3. Roll shops division of Fairfield Works

On December 31, 1975, one of the three remaining open hearth furnaces at Ensley Operations was idled. On June 30, 1976, the

the remaining two open hearth furnaces were shut down. The processes within the existing iron and steel-making facilities at Fairfield Works are described below. A discussion of the existing steel-making facilities must begin with handling of the raw materials required for steel making. This discussion will follow the process steps outlined in Figure 3-1.

3.1.1.1. Raw Materials Handling

Iron Ore. The major raw materials required by Fairfield Works are iron ore, iron ore pellets, coal, dolomite, and limestone. Iron ore is transported by rail to the sinter plant. The iron ore is screened. The 3/8 in. material from the screening plant is conveyed to storage silos and loaded in railroad cars for shipment to the blast furnaces as coarse ore. Ore pellets are taken directly to the blast furnace area from pellet stockpiles for charging to the furnace. Iron ore is taken to the sinter plant for treatment.

Fluxstone. Dolomite is required at the sinter plant for inclusion in the blast furnace charge. The mineral mined is high in calcium and magnesium. Dolomite and limestone for the blast furnace require careful sizing, because the rate at which reactions proceed is dependent upon the exposed surface area. The preferred size of dolomite for sintering is less than 1/8 in.; the optimum size for blast furnaces is 2 to 4 in. Limestone and dolomite to be used for sintering are unloaded at the track hopper as needed. The limestone (fluxstone) goes directly to the blending beds. The fluxstone, flue dust, and coke are screened and the oversize (>1/8 in.) is ground in the rod mill to <1/8 in.

Chunk dolomite is transported to the blast furnaces by rail in hopper-bottom open cars. Crushed dolomite is taken to the sinter plant in semi-trailers and put into storage, from which it is drawn into the blending bed as needed.

For the Q-BOP, burnt lime is required. Burnt lime, provided by an outside contractor, is produced by the calcination of

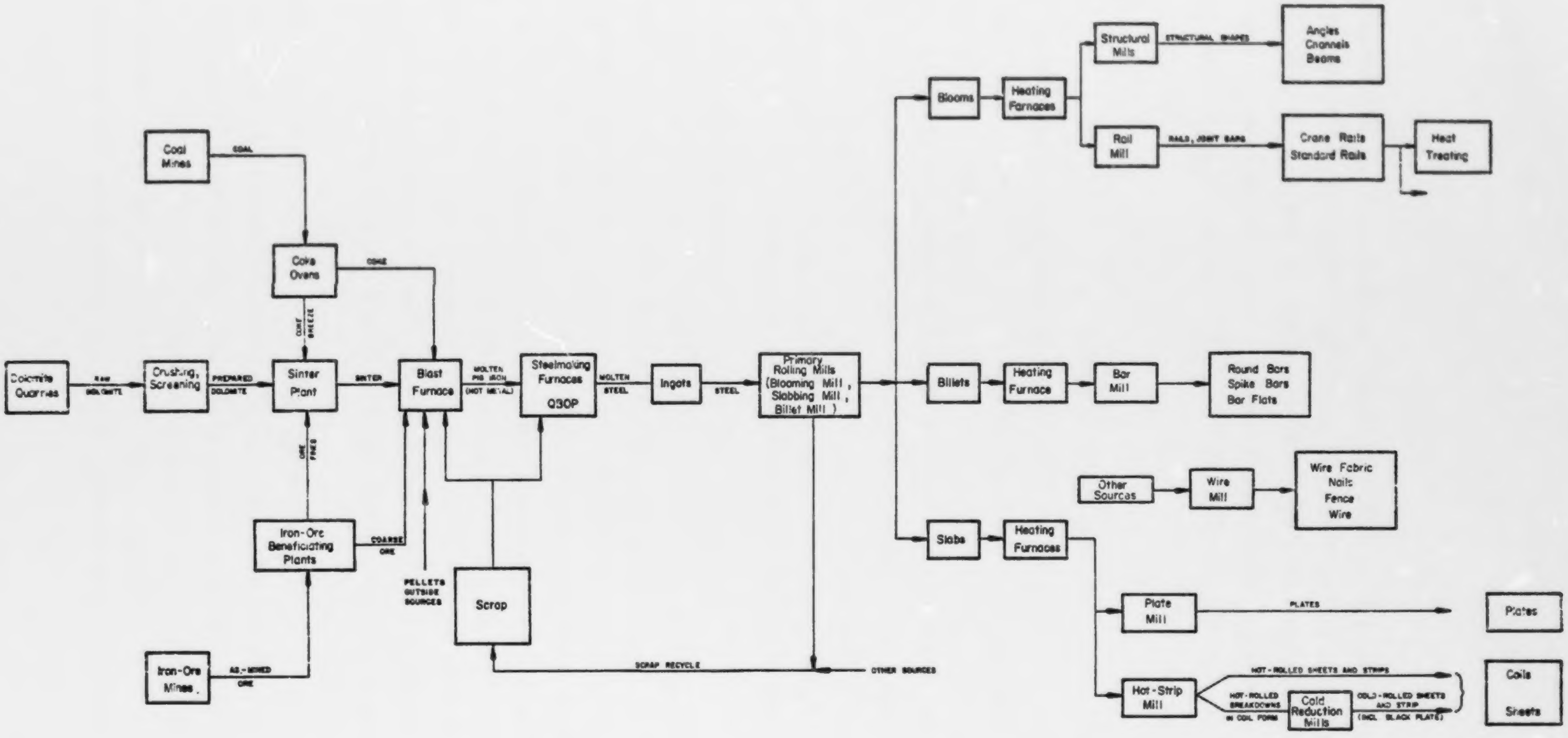

Coal Mines
COAL
Coke Ovens
COKE
COKE BREEZE
Dolomite Quarries
RAW DOLOMITE
Crushing, Screening
PREPARED DOLOMITE
Sinter Plant
SINTER
Blast Furnace
MOLTEN PIG IRON (HOT METAL)
Steelmaking Furnaces Q3OP
MOLTEN STEEL
Ingots
STEEL
Primary Rolling Mills (Blooming Mill, Slabbing Mill, Billet Mill)
ORE FINES
Iron-Ore Beneficiating Plants
COARSE ORE
PELLETS OUTSIDE SOURCES
Scrap
Iron-Ore Mines.
AS-MINED ORE
SCRAP RECYCLE
OTHER SOURCES
Blooms
Heating Furnaces
Structural Mills
STRUCTURAL SHAPES
Angles Channels Beams
Rail Mill
RAILS, JOINT BARS
Crane Rails Standard Rails
Heat Treating
Billets
Heating Furnace
Bar Mill
Round Bars Spike Bars Bar Flats
Other Sources
Wire Mill
Wire Fabric Nails Fence Wire
Slabs
Heating Furnaces
Plate Mill
PLATES
Plates
Hot-Strip Mill
HOT-ROLLED SHEETS AND STRIPS
HOT-ROLLED BREAKDOWNS IN COIL FORM
Cold Reduction Mills
COLD-ROLLED SHEETS AND STRIP (INCL. BLACK PLATE)
Coils
Sheets

FIG. 3-1. FLOW DIAGRAM SHOWING THE PRINCIPAL PROCESS STEPS INVOLVED IN CONVERTING RAW MATERIALS INTO THE MAJOR PRODUCT FORMS, (EXCLUDING COATED PRODUCTS) AT FAIRFIELD WORKS.

limestone in large rotary kilns. The process consists of a continuous roasting of limestone that leaves a CaO residue. The residue is pumped into trucks pneumatically using compressed air. The trucks then transport the burnt lime to a pressurized vessel located near the Q-BOP at the Fairfield plant. The burnt lime is fluidized by the positive pressure.

Coal. Coal is mined at locations within Alabama and at locations in other states. Concord and Oak Grove coal are washed in the Concord coal preparation plant and then transported directly to the coke plant via truck or railroad cars.

At an unloading station, coals of different composition are dumped and transferred into stock from which they may be drawn in the proper proportions to provide the chemical blend necessary for coking. From this point, the mixture is fed by conveyor belt to overhead storage bins of two to four thousand tons capacity. These bins, each of which is equipped with hopper-type openings at the bottom, are fed by gravity into vehicles called larry cars which run on tracks atop the coke batteries and discharge the coal as it is required into the coke ovens.

3.1.1.2. The Coke Plant

Coal is received and sent to the coke plant at Fairfield where it is put into bins. Bins are located so that each serves two or more coke batteries. Each coke oven has, in its top, four holes through which coal is charged from the four compartments of the larry car. Fairfield Works currently has seven coke batteries, with a total of 489 ovens.

The ovens are sealed and then heated from below. The volatile gases contained by the coal are driven off by the heat and trapped in distillation apparatus for by-product recovery. The result of this heating process is a material of low moisture content and high carbon content (coke). The hot coke is pushed out of the opened ovens into cars and subsequently quenched with water.

The volatile gases driven off during the coking process are scrubbed with water in a separate system to distill and recover the various valuable chemicals contained within the hot gas. A detailed description of the procedures for coking will be presented subsequently.

3.1.1.3. Sinter Plant

A sintering plant agglomerates finely divided iron ore and various iron-bearing materials, such as blast furnace flue dust, mill scale, turnings, borings, and similar iron units generated within a steel plant. The sintered materials are then suitable for blast furnace feed because of the resulting improved physical properties of the agglomerates together with higher iron content and reduced moisture.

A sintering machine is a continuous traveling grate called a strand. A mixture of fine ore, crushed dolomite, and fine coke (breeze) is placed on a grate traveling over a series of windboxes. The mixture is ignited with a burner, and the fire moves down through the mixture as air is drawn down through the ore by fans. The generated heat sinters the particles together into a realtively hard, porous mass.

The use of sinter in blast furnaces has significantly improved furnace performance and productivity. Two important innovations have been to utilize sized sinter and to incorporate dolomite in the sinter, which serves as a fluxing agent in the blast furnace. The latter is a favorable alternative to separately charging fluxstone to the top of the furnace because it reduces the alkali required in the furnace charge. It also tends to reduce coke consumption because the dolomite in the sinter is calcined on the sintering grate, rather than in the blast furnace. The sinter plant has a limited capacity and is presently operating at the maximum sinter burden all of the time. Construction of the new No. 8 blast furnace will increase potential iron production and there will be a corresponding potential for increase in the basicity of the sinter. The small amount of increase of basicity up to approximately 1.4 should have little or no effect on the resistivity of the emissions. With sized sinter, small particles are screened out prior to charging; this has also improved blast furnace performance. Sinter from No. 4 sinter strand is air cooled, while sinter from Nos. 1, 2, and 3 strands are water cooled.

3.1.1.4. Blast Furnaces

Reduction of iron from iron ore sources is accomplished in the blast furnaces using coke as fuel and dolomite as a flux to aid the process. These basic ingredients are processed and prepared by the initial processes discussed previously. These materials are charged to the blast furnaces for iron smelting. A detailed discussion of the process and methods of operation is provided in a later chapter.

3.1.1.5. Q-BOP's

The Q-BOP essentially is a furnace in which molten iron is transformed to molten steel by blowing a jet of oxygen into the bottom of the molten bath and adding fluxes to form a slag or layer of impurities on top of the bath. A complex chemical interaction takes place which lowers the carbon content of the iron, causing it to change to a mild steel. The furnace is then tapped. The steel drains into the tapping ladle and the resultant slag is poured into a slag pot.

3.1.1.6. Teeming

Heats of molten steel, which have been tapped into steel ladles at the Q-BOP, are transported to the pit teeming platforms by the overhead ladle cranes, and positioned directly over a trip of ingot molds. By use of a stopper rigging incorporated in the steel ladle, a stream of steel is allowed to flow from the bottom of the ladle into the ingots mold positioned directly under the ladle. Each ingot mold is poured to a desired height before closing the stopper. After pouring, the ingot mold is transported from the teeming platform to the stripping yard where the mold is stripped from the ingot.

3.1.1.7. Soaking Pits

A soaking pit is a refractory-lined, gas-fired heating chamber. Ingots are placed in these pits in a vertical position before being rolled and are allowed to gradually "soak up" heat over a period of several hours until they have reached a uniform temperature throughout each ingot. From the soaking pits, the steel ingots are taken to the primary mills to be shaped into blooms and slabs.

3.1.1.8. Primary Mills

The term primary mill is generally used to describe a mill that produces billets, blooms, and slabs. The primary operations convert ingots into a semi-finished steel and the semi-finished steel product into pieces of desired cross-section and weight. Auxiliary operations include heating, cropping, conditioning, cutting to length, and collecting and assorting crops, roll scale, and other by-products that are returned to the steel-producing and blast furnace departments. Ingots are removed from the soaking pits when they reach rolling temperature and delivered to the ingot feed table of one of the primary mills. Ingots are then given several passes between the mill rolls. An ingot is turned several times during rolling.

The steel flow diagram splits into three streams during primary rolling: blooms go to the structural, axle and rail mills; billets go to the rod and bar mills; slabs go to the plate and hot strip mills (see Figure 3-1).

3.1.1.9. The Tin Mill

Hot Rolling Mills. The primary mills deliver steel in the form of slabs 5 in. to 9 in. thick to the hot strip mill within the tin mill. The slabs enter a scale breaker which removes scale from the flat surface of the slab. The hot strip mill uses roughing stands, scale breakers, and finishing stands to reduce the hot slab to a strip of uniform, specified thickness.

Pickling. Raw coils from the hot strip mill are delivered to the pickle lines where they are cleaned and pickled. Pickling is done with a solution of hot sulfuric acid or hydrochloric acid. In the hot strip operation, steel was rolled at elevated temperatures in the presence of air. This caused an oxide, commonly referred to as scale, to form on the surface.

The scale on the surface of the hot rolled strip is removed by a process called pickling. The pickler consists of:

1. An uncoiler
2. A welder or stitcher for joining coil ends
3. A scale breaker
4. A horizontal tank containing sulfuric acid or hydrochloric acid
5. A tank of rinse water
6. End shearing and side trimming equipment
7. A recoiler and oiler

After pickling and oiling, the coils are placed in storage awaiting the next operation, or are sold as hot rolled, pickled coils.

Cold Reduction. After the strip is cleaned, pickled, and oiled, it is recoiled for cold reduction. The coil is cold reduced on Tandem Mills Nos. 3 and 4.

Electrolytic Cleaning. The lubricants applied to the strip must be removed prior to coating. The strip passes through a cleaning line in which it is immersed in a bath of detergent solution. The detergent solution cleans the steel and serves as a conductor of electric current between electrodes and the product being cleaned.

Annealing. Before being coated, the steel strip is softened by annealing to eliminate the brittleness caused by cold reduction rolling. The strip is annealed in an atmosphere of inert gas to eliminate surface oxidation. The gas conditioning system provides an oxygen-free gas (reducing atmosphere) which prevents oxidation.

Coating. The final process at the tin mill is to coat the strip with a thin layer of tin. Fairfield Works has three of these electrolytic tin lines.

3.1.1.10. The Sheet Mill

All steel processed at the sheet mill is received in coil form from the tin mill in railroad cars. The coils are then processed through the mill into the following products:

1. Painted coils
2. Galvanized or zinc-coated coils and sheets
3. Cold-rolled and hot-rolled steel which has been processed through various operations of the mill
4. Corrugated materials

Those strips which are to enter one of the galvanizing lines pass through enclosed tanks containing a mild caustic solution which removes any dirt or grease which has accumulated on the surface of the strip in prior operations. After cleaning and rinsing, the strip passes into a controlled atmospheric furnace. The strip passes from this furnace into the kettle of molten zinc where it picks up the galvanized coating.

Galvanized sheets begin with a steel coil delivered to the entry end of a galvanizing (zinc-coating) line. The steel strip travels through a continuous strip annealing furnace where the strip is softened and brittleness is reduced.

The cleaned and softened steel strip is then ready for a protective coating which is applied when the strip passes through a bath of molten zinc and between two jets of air that wipe the strip, leaving a coating of molten zinc at the prescribed thickness.

After being galvanized, the strip is cooled, chemically treated, and cut into sheets or recoiled. Galvanized steel is then ready for shipment.

Some galvanized coils are delivered to the paint line where a wide variety of combinations of prime and finish coat enamels are baked on. The paint line prepares painted sheets and coils ready for shipment.

3.1.1.11. The Wire Mill

Before being drawn into wire, steel rods are pickled in hot sulfuric acid, rinsed, and neutralized in a lime bath. Steel wire, before being zinc-coated, is drawn through a hot hydrochloric acid bath which cleans the wire.

Wire lengths are drawn and cut to form nails. Nails are hardened by quenching. Nails at the wire mill are coated by applying a cement coating to the nails. Nails are cleaned in the Nos. 1 and 2 degreasers.

3.1.1.12. Emissions Projections

The processes operating at Fairfield Works generate particulate emissions during the manufacture of steel and various intermediate products. Each emission source operates under a permit. Control techniques are employed to reduce the final particulate content of the gas vented to the atmosphere below an amount specified by the process control weight table in the Jefferson County rules and regulations.

The Universal Transverse Mercator (UTM) coordinates for each emission source used in the Air Quality Display Model are presented in Appendix A-3 of the Technical Support Document. A list of identifiable air pollution control devices and resultant residue disposal methods is also presented in Appendix A-6 of the Technical Support Document. A list of procedures for emissions control and rehabilitation of existing coke batteries (maintenance plan) is presented in Table 3-1.

The Environmental Protection Agency, on April 15, 1976, prepared a case study concerning designated new source construction in

TABLE 3-1

EXISTING COKE BATTERIES REHABILITATION AND EMISSION CONTROL PROGRAM
MAINTENANCE PLAN

Item of Work	No. 9	Nos. 3 & 4	No. 7	No. 8	Nos. 5 & 6
1. Ovens*	Rebuild walls in 23 ovens not operating	Extensive spot brick replacement of all walls & end flues.	Extensive spot brick replacement of all walls & end flues.	Spot brick replacement in 30 walls plus repairs to end flues.	Spray patch end flues and replace brick as necessary.
2. Buck Stays	Replace 23 on coke side. Replace 23 on pusher side.	Replace 22 on coke side of No. 3. Replace 22 on coke side of No. 4.	Replace 10 on coke side.	Replace 17 on coke side. Replace 23 on pusher side.	Replace 32 on No. 5 Replace 12 on No. 6
3. Jamb Castings	Replace 30 on coke side.	Replace 60 on coke side. Replace 30 on pusher side.	Replace 25 on coke side. Replace 12 on pusher side.	Replace 63 on coke side. Replace 24 on pusher side.	Replace 30 on coke side. Replace 12 on pusher side.
4. Chuck Doors	Replace 12	Replace 30	Replace 12	Replace 36	Replace 12
5. Oven Doors (Replacement)	Replace 30 on coke side. Replace 12 on pusher side.	Replace 24 on coke side. Replace 12 on pusher side.	Replace 12 on coke side. Replace 12 on pusher side.	Replace 12 on coke side. Replace 12 on pusher side.	Replace 12 on coke side. Replace 12 on pusher side.
6. Oven Doors (Relines)					Reline 18 doors on No. 5. Reline 13 doors on No. 6.
7. Charging Hole Castings	Reset 40 percent. Repair paving.	Reset 75 percent.	Reset 75 percent & patch all others.	None	Replace 35 on No. 5 Replace 88 on No. 6
8. Joints & Glands	Repack 63 goosneck and damper glands.	Repack 146 gooseneck and damper glands.	Repack 63 gooseneck and damper glands.	Repack 63 gooseneck and damper glands.	Repack 154 gooseneck and damper glands.
9. Battery Machinery	Repair	Repair	Repair	Repair	Repair
10. Face Plates and Parapet Walls		Replace face plates.		Point up parapet walls on both sides.	
11. Tie Rods	Adjust 100 percent transverse tie rod springs.	Adjust 100 percent transverse tie rod springs.	Adjust 100 percent transverse tie rod springs.	Replace longitudinal tie rods, adjust 100 transverse tie rod springs.	Adjust 100 percent transverse tie rod springs.
12. Off-Take Assemblies (Goosneck & Standpipes)	Replace 23	Replace 58	Replace 30	Replace 20	Replace 26
13. Quench Stations	Rebuild & install baffles (1 station serving Nos.7,8,9)	Rebuild & install baffles (2 stations serving Nos. 3 & 4)	Rebuild & install baffles (1 station serving Nos.7,8,9)	Rebuild & install baffles (1 station serving Nos.7,8,9)	Rebuild & install baffles (2 stations serving Nos. 5 & 6)
* Brick count	24,600	22,800	16,900	23,800	

non-attainment air quality areas. One of the two examples in the study was the proposed changeover from open hearth technology to basic oxygen furnace technology at U. S. Steel's Fairfield Works. The analysis was later modified to reflect revised emission data. The revised analysis appears in the Technical Support Document (Appendix A-2).

The EPA projections, which are listed in Table 3-2 provide estimates of past and future emission levels for the Fairfield/ Ensley complex. U. S. Steel reviewed this study, and while concurring with the conclusions, they do not necessarily agree with the individual EPA calculations; however, United States Steel did agree to the use of the calculations for determining the incremental impact of the proposed facilities. Changes in emission levels are shown in Figure 3-2.

3.1.1.13. Effluents Inventory

The processes operating at Fairfield Works also generate effluents during the manufacturing of steel. The wastestreams generated from each process are individually treated where required. Effluent streams with less stringent treatment requirements are consolidated and treated in one of the wastewater treatment plants located on each wastewater stream at Fairfield operations. The treated effluent from each of these plants is then directed to a final effluent control pond with the exception of the wastewater treatment plant effluent from the wire mill operations. This water enters Opossum Creek directly. A permanent automatic sampling station on Opossum Creek below both U. S. Steel outfalls monitors the characteristics of the total plant discharge, including treated process water, cooling water, and run-off. An overall schematic of the effluent treatment plan for Fairfield operations is presented in Figure 3-3 and a summary included in Table 3-3.

Outfalls 002 through 009 are the discharges from Ensley Works. The State-imposed discharge limitations for each of these outfalls are on a net milligram-per-liter basis--TSS, 50 average/100

TABLE 3-2

SUMMARY OF EPA CASE STUDY OF U. S. STEEL
NEW SOURCE REVIEW ANALYSIS
PARTICULATE EMISSIONS
(Ton/Year)

March, 1976, Birmingham, Alabama

	Pre 1972 Emission Levels		Unconstructed New Facilities		Post Moderni-zation Emissions	Pre 1972 Emissions With Control		Post Modernization B. F. Plus Old Coke Batteries
	Fairfield	Ensley	Without BACT	With BACT		Fairfield	Ensley	
I. Blast Furnace								
Top Gas	355.7	3,188.6	56.3	56.3	404.1	355.7	579.7	579.7
Cast House	377.5	261.0	392.2	225.4	761.3	377.5	261.0	261.0
Stack House	21.7	15.0	22.5	22.5	43.7	21.7	15.0	15.0
Material Loading	147.5	102.0	153.3	1.5	297.5	147.5	102.0	102.0
Leaks and Kicks	217.0	150.0	225.4	225.4	437.5	217.0	150.0	150.0
Storage Piles	36.5	25.2	38.4	38.4	72.8	36.5	25.2	25.2
Total	1,155.9	3,741.8	888.1	569.5	2,016.9	1,155.9	1,132.9	1,132.9
II. Q-BOP								
Stack			4.7	4.7	14.2			5.0
Fugitive			234.6	2.3	703.8			249.9
Total			239.3	7.0	718.0			254.9
III. Coke								
Coal Handling	140.2		99.4	99.4	167.6	140.2		48.3
Charging	2,474.0		49.4	49.4	109.6	123.7		42.6
Leaks	362.9		31.7	31.7	92.5	124.9		43.0
Pushing	2,538.0		165.4	5.0	1,971.6	2,538.0		874.2
Quenching	1,979.2		789.6	19.7	1,752.9	1,979.2		681.8
Underfiring Stacks	643.3		78.3	39.1	173.8	196.3		67.6
Coal Storage Piles	44.5		--	--	21.7	44.5		15.3
Coke Screening	8.9		{6.3		10.7	8.9		3.1
Coke Handling	--			6.3	--	--		--
Total	8,191.0		1,220.1	250.7	4,300.4	5,155.7		1,775.9
IV. Open Hearth								
Stack	32,130	9,520				180.2	77.3	
Fugitive	6,426	1,904				6,426.0	1,904.0	
Total	38,556	11,424				6,606.2	1,981.3	
TOTALS: CASE	63,068.7 "A"		2,347.5 "B"	827.2 "C"	7,035.3 "D"	16,032 "E"		3,163.7 "F"

"A" - Fairfield Works pre-1972 emissions, "B" - emissions from B. F. #8 and replacement facilities,
"C" - "B" with BACT, "D" - emissions from Fairfield Works after completion of modernization,
"E" - Fairfield Works pre-1972 with control devices on emissions, "F" - emissions from to-be-replaced old facilities.

EPA

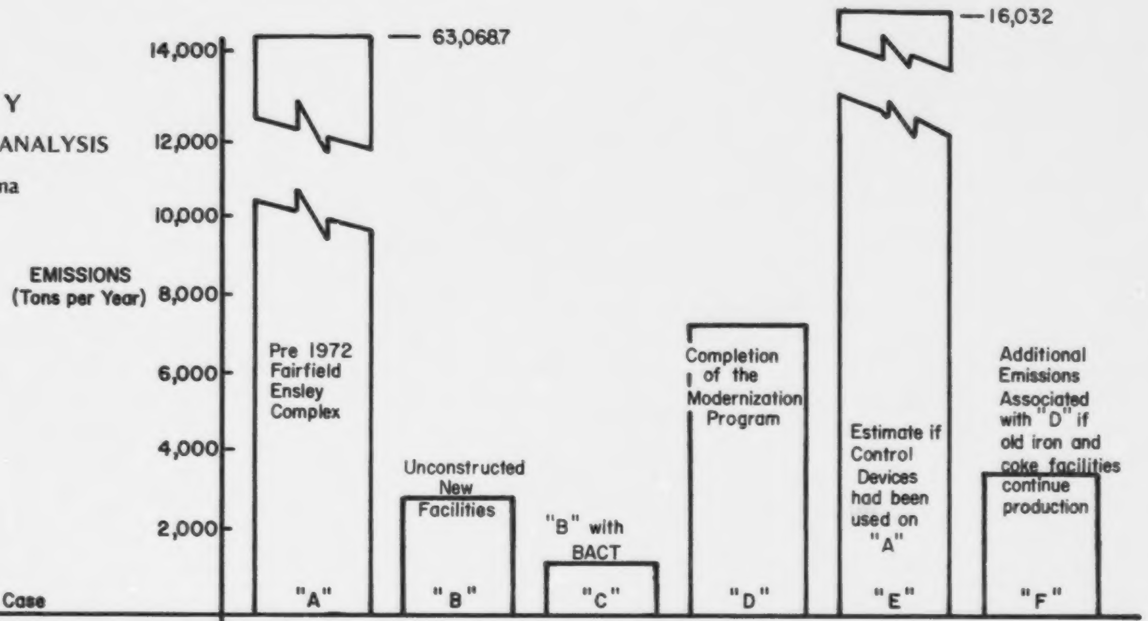
U.S. STEEL

CASE STUDY

NEW SOURCES REVIEW ANALYSIS

Birmingham, Alabama

March, 1976



	Case	"A"	"B"	"C"	"D"	"E"	"F"
FAIRFIELD	BLAST FURANCE	1,155.9	888.1	569.5	2016.9	1,155.9	
	Q-BOP		239.3	7.0	718.0		254.9
	COKE	8,191.0	1,220.1	250.7	4,300.4	5,155.7	1,775.9
	OPEN HEARTH	38,556.0				6,606.2	
ENSLEY	BLAST FURNACE	3,741.8				1,132.9	1,132.9
	OPEN HEARTH	11,424.0				1,981.3	
TOTAL (Tons per Year)		63,068.7	2,347.5	827.2	7,035.3	16,032	3,163.7

FIG. 3-2. EMISSION LEVELS, PRE-1972 LEVELS AND SUBSEQUENT TO COMPLETION OF THE MODERNIZATION PROGRAM

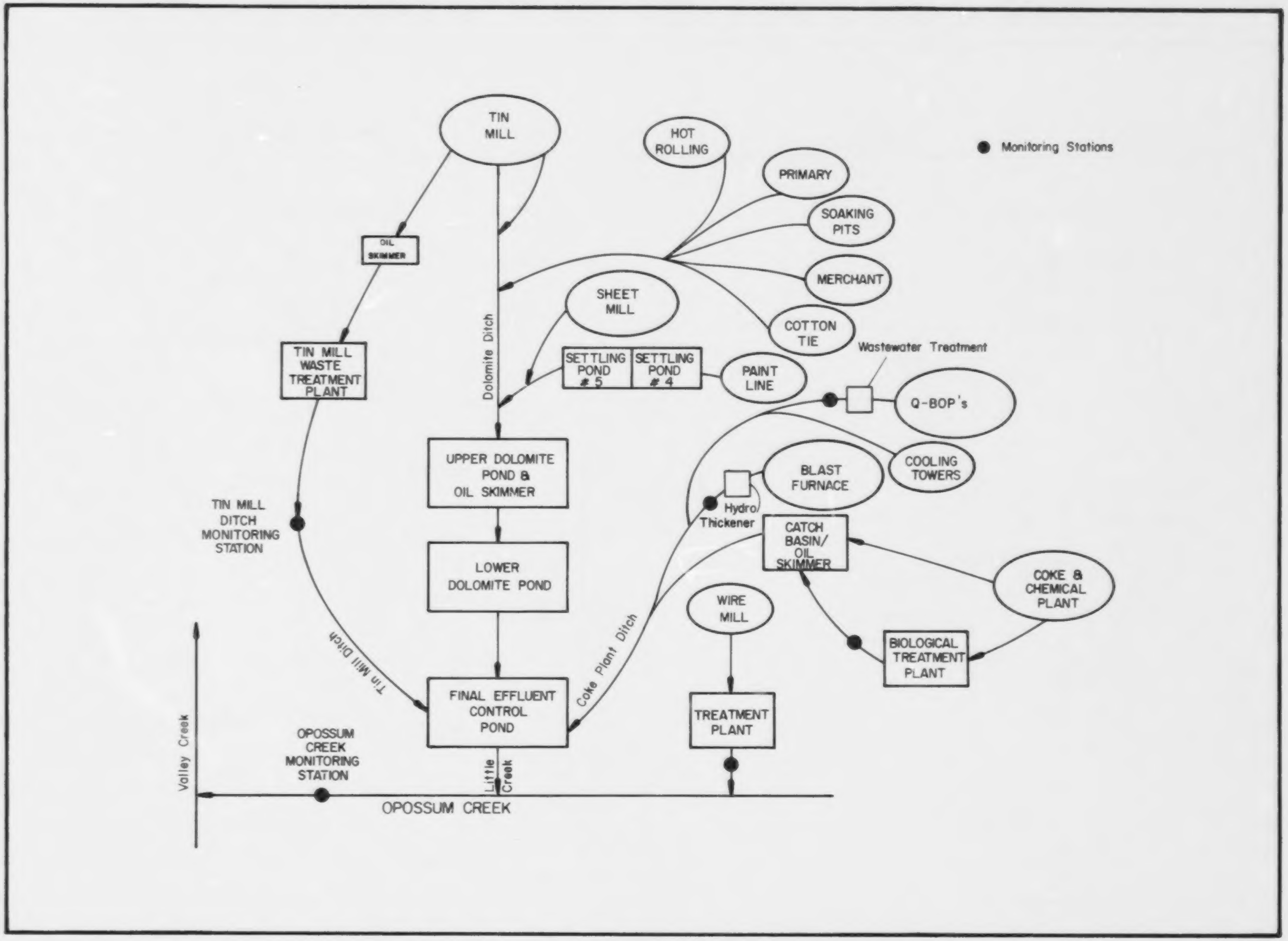

TIN MILL
HOT ROLLING
PRIMARY
SOAKING PITS
MERCHANT
COTTON TIE
SHEET MILL
OIL SKIMMER
TIN MILL WASTE TREATMENT PLANT
Dolomite Ditch
SETTLING POND # 5
SETTLING POND # 4
PAINT LINE
Wastewater Treatment
Q-BOP's
COOLING TOWERS
BLAST FURNACE
Hydro Thickener
UPPER DOLOMITE POND & OIL SKIMMER
LOWER DOLOMITE POND
CATCH BASIN/ OIL SKIMMER
COKE & CHEMICAL PLANT
BIOLOGICAL TREATMENT PLANT
WIRE MILL
TIN MILL DITCH MONITORING STATION
Tin Mill Ditch
Coke Plant Ditch
FINAL EFFLUENT CONTROL POND
TREATMENT PLANT
Valley Creek
OPOSSUM CREEK MONITORING STATION
Little Creek
OPOSSUM CREEK
● Monitoring Stations

FIG. 3-3. OVERALL EFFLUENT TREATMENT SYSTEM FOR FAIRFIELD OPERATIONS

TABLE 3-3

SUMMARY OF WASTEWATER TREATMENT FACILITIES

Sintering Plant

Sintering & Ore Conditioning Plant - Settling Basins
Sintering Plant - Septic Tank & Bio Filter - Settling Basins, also

COKE & COAL CHEMICAL DIVISION

Sanitary Sewer System - Wastewater Treatment Facilities

- Ammonia Stills
- Contaminated Water Collecting System
- Recycle Coke Quenching
- Primary Gas Cooling Tower
- Final Gas Cooling Tower

BLAST FURNACE

Fairfield Blast Furnaces Nos. 5, 6, & 7 - Wastewater Treatment Facilities
- Recycle Underflow & Treat Overflow - Hydrothickener

- Gas Cleaning - Water Treatment & Sludge Handling System

Ensley Blast Furnace Nos. 1, 2, & 3 - Gas Cleaning - Water Treatment & Sludge Handling System

STEEL PRODUCTION

Q-BOP - Gas Cleaning Facilities - Water Treatment & Sludge Handling

HOT ROLLING

Ensley Mills - Treat (or recycle) mills wastewater

TABLE 3-3 (Cont'd)

SUMMARY OF WASTEWATER TREATMENT FACILITIES

Tin Mill

Pickle Line No. 3 - Spent Acid collecting system
Pickle Line No. 4 - Spent Acid collecting system
Tin Mill Ditch - Wastewater Treatment System
Electrolytic Tinning Line No. 1 - Spent Acid collecting system
Electrolytic Tinning Line No. 3 - Spent Acid collecting system
Electrolytic Tinning Line No. 4 - Spent Acid collecting system
Electrolytic Tinning Line No. 1 - Chem-treat rinse water to Wastewater Treatment Plant - tank, pumps & piping
Electrolytic Tinning Line No. 3 - Chem-treat rinse water to Wastewater Treatment Plant - tank, pumps & piping
Pickle Lines 3 & 4 - Spent Acid Pumps and Piping Transfer Facilities to Deep Well

Sheet Mill

Acid Neutralizing Plant & Sludge Ponds
No. 4 Galvanizing Line - Spent Acid Collecting System
Paint Line - Collecting System for Paint Line Waste
Hauling waste to Tin Mill Ditch
Galvanizing Lines - Collecting system for chrome wastes
Hauling waste to Tin Mill Ditch
Outfall 022 - Pump station and piping to intercept and transfer wastewater to Dolomite system

Wire Mill

Nail Quench Tank - Use of septic tank truck
Rod Pickling - Spent acid collecting system
Galvanizing Lines - Spent acid collecting system

Wastewater Treatment Facilities

Coke Plant - Biological Treatment Plant
Wire Mill - Chemical Treatment Plant
Deep Well, Surface Facilities & Emergency Lagoon
Wastewater Treatment Plant - Modifications
Coke Works Ditch - Pump Station & Piping to transfer wastewater to final effluent Control Pond
Tin Mill Ditch - Chrome treatment facilities
Seven (7) Monitoring Stations
Effluent Control Pond

Dolomite Recirculating System - Oil Removal Facilities
Dolomite Recirculating System - Mill Scale Settling Pond
Dolomite Recirculating System - pH Control
Shops Steam Plant - Reclaimed Oil Burning Facilities
Ensley Mills Wastewater - Chlorinating System

maximum; zinc, 1 average/2 maximum; and pH, 6.0 to 9.0. The actual net mean discharge concentrations (mg/l) of oil and grease and total suspended solids are presented in Table 3-4. These values are in compliance with State-imposed effluent limitations. In addition to the State's effluent limitations, EPA has imposed additional net mean discharge rate (lb/day) limitations for ammonia, cyanide, and phenol. These limitations and the current mean discharge rate from outfall 002, expressed in net lb/day, are also presented in Table 3-4. These lb/day loadings can be converted to mg/l by the use of an average flow of 6 mgd. Additional data are provided in Table 3-5. The effluents from Ensley enter Village Creek at approximately river mile 27.5.

The net mean concentrations noted in Tables 3-4 and 3-5 represent the current quality of discharges from Ensley Works. After the Nos. 1, 2, and 3 blast furnaces are idled, flow from outfalls 002 and 004 (a total of 8.6 mgd) will be essentially terminated and approximately 0.6 mgd from outfall 003 will be terminated. The result of the idling of blast furnaces 1, 2, and 3 will be a deletion of the ammonia, cyanide, and phenol (outfall 002) loadings from Ensley Works to Village Creek and a reduction of the overall flow from Ensley Works to Village Creek of approximately 9.9 mgd. The quality of the remaining effluent will continue to meet the State-imposed effluent limitations for total suspended solids, oil and grease, zinc and pH.

The quality of the discharge from the Wenonah plant will not change with the facility changes at either Ensley or the Fairfield plants. The current net mean values (mg/l) for the Wenonah discharge in terms of BOD, oil and grease, total suspended solids, and fecal coliform, as well as the NPDES effluent limitations expressed in terms of mg/l at average and maximum, are also presented in Table 3-5. In addition to the values shown in the table, a pH limitation of 6.0 to 9.5 is specified in the NPDES permit. As noted above, the quality and quantity of the current discharge from the Wenonah plant will not be changed as a result of any of the facility

TABLE 3-4

DISCHARGES FROM ENSLEY WORKS AND EFFLUENT LIMITATIONS

Outfall	Flow (mgd)	Net Mean (mg/l)	
		Oil & Grease	TSS
002	6	7.4	15
003	1.5	4.7	0
004	2.6	3.3	10
005	1.7	4.6	28
006	0.2	3.7	13
007	0.001	9.8	9
008	7.3	4.5	9.5
009	2	6.2	0

All outfalls meet flow weighted state imposed limits of:

TSS	50 mg/l average	100 mg/l maximum
O & G	15 mg/l average	30 mg/l maximum
Fe	5 mg/l average	10 mg/l maximum
Zn	1 mg/l average	2 mg/l maximum
pH	6.0 - 9.0	

For 002 the following net mean lb/day values also apply:

	Mean	BPT Avg.	BPT Max.
NH_3	103	472	1,416
CN	13	57	171
Phenol	1.8	15	45

When the Ensley B.F. is down, Outfalls 002 and 004 are reduced by 8.6 mgd and Outfall 003 is reduced by 0.5 mgd.

TABLE 3-5

ENSLEY AND WENONAH ACTUAL MEAN[a] FOR NPDES EFFLUENT LIMITATIONS

Outfall	Parameter	Mean	NPDES Average	NPDES Maximum
Ensley				
002	TSS	15	50	100
	O & G	7.4	15	30
	Fe		5	10
	Zn		1	2
(lb/day)	NH_3	103	472	1,416
(lb/day)	CN	13	57	171
(lb/day)	Phenol	1.8	15	45
003	TSS	0	50	100
	O & G	4.7	15	30
	Fe		5	10
	Zn		1	2
004	TSS	10	50	100
	O & G	3.3	15	30
	Fe		5	10
	Zn		1	2
005	TSS	28	50	100
	O & G	4.6	15	30
	Fe		5	10
	Zn		1	3
006	TSS	13	50	100
	O & G	3.7	15	30
	Fe		5	10
	Zn		1	2
007	TSS	9	50	100
	O & G	9.8	15	30
	Fe		5	10
	Zn		1	2
008	TSS	9.5	50	100
	O & G	4.5	15	30
	Fe		5	10
	Zn		1	2
009	TSS	0	50	100
	O & G	6.2	15	30
	Fe		5	10
	Zn		1	2
Wenonah				
029	BOD	7.6	30	45
(Gross mg/l)	O & G	6.4	10	20
	TSS	21	40	60
	F. Coli.		200/100	400/100

---

[a] All net mg/l unless indicated

changes discussed in this report. The discharge from Wenonah enters Valley Creek at river mile 50.0.

The combined flows from Fairfield discharges (originally outfalls 010 through 027) are monitored at the Opossum Creek monitoring station. Opossum Creek then flows into Valley Creek at river mile 41.4. The net mean loading (lb/day) monitored at the Opossum Creek monitoring station represents the present quality and quantity of the Fairfield discharge, adjusted for the third Q-BOP furnace, as shown in Table 3-6.

The new coke battery replaces existing batteries, and treatment to the new battery will be comparable to that which was provided for discharges from the old batteries.

3.1.1.14. Solid Waste Residues

Residues are generated by operation of the various air and water pollution control devices. These residues are identified by source and disposal methods at Fairfield Works in Table 3-7, which lists the eleven identifiable residues from polluton control equipment at this facility. As noted, most of these materials are either directly reused in the sinter process or placed in stock for anticipated recycle at a later date.

3.1.2. Proposed Replacement Facilities

3.1.2.1. Coke Battery No. 2

A new 57-oven coke battery is scheduled to replace existing coke batteries Nos. 3, 4, 7, and 8. EPA has designated this new battery as a replacement facility. Prior to considering the emissions from coke battery No. 2, a description of the coking operation is presented which relates to emission control. The replacement facility will occupy the site of former coke batteries 1 and 2.

Coke Handling and Preparation. Coking coal is supplied to the Coke Department by truck and by rail. Truck receipts are discharged directly to ground storage. Railroad car receipts can be discharged

TABLE 3-6

FAIRFIELD ACTUAL MEAN AND NPDES EFFLUENT LIMITATIONS
AS MEASURED AT OPOSSUM CREEK MONITORING STATION
OUTFALLS 010 - 027

(Net lb/day Unless Indicated Otherwise)

Parameter	Consent Decree		NPDES Permit		Net Mean	Avg. Limits	
	Avg.	Max.	Avg.	Max.		BPT	BAT
Flow	(Assumes 20 mgd flow)						
Temp.	95°F	105°F		95°F			
pH	6.0 -	8.5					
Spec. Cond.							
TSS	1,200	4,000	4,125	8,050	707	11,621	1,469
O & G	450	1,000	780	1,641	319	4,350	547
BOD_5	5,000	7,500					
COD	12,000	18,000	12,690	21,074	6,726		
Fe_{TD}	300	600	300	600	8	35	35
Cu_T	16	30					
Zn_T	30	60	36	72	167	49	5
T.D. Solids		84,000			75,489		
NH_3-N		1,740		1,740	1,113	1,949	115
Phenol		35		35	1.78	44	6
Arsenic		8			4.1		
Cr^{+6}		1			0	0.05	0.05
Sn	155	310	155	310	4.37	233	
Cr_r	10	30	10	30	1.51	30	0.05
Cr_{TD}			10	30			
F	230	345	609	959	340		201
Pb	20	30			15.5		
Antimony	15	22.5			2.45		
Mn	100	150			34.9		
CN		50		50	13.1	490	
Hg		0.1			0		
D.O.	2 mg/l-min.		{5 mg/l-avg. 4 mg/l-min.}				
Fe_T							
Cd		2			0.21		

Consent decree limits without Q-BOP and other adjustments

NPDES permit limits are final including third Q-BOP

Mean limits are projected from ten dry day test data to include third Q-BOP impact at 1.5 x 2 Q-BOP values and assumes no effect from new coke battery

Net mean Zn_T monitoring has been in compliance with NPDES limits since 7/1/77

TABLE 3-7

POLLUTION CONTROL RESIDUES
FAIRFIELD DISTRICT WORKS
U. S. STEEL CORPORATION*

Source	Annual Quantity Residue - dry tons	Residue Produced/ Ton Q-BOP Steel** (Percent)	Disposition of Residue
DUST			
Sintering	15,500	0.6	Sinter
Blast Furnace	73,800	2.7	Sinter
Q-BOP	6,480	0.2	Sinter
SLUDGE			
Sintering	23,600	0.9	Stock
Blast Furnace	13,290	0.5	Sinter
Rolling	15,600	0.6	Stock/Sinter
Pickling	1,600	0.1	Landfill
FILTER CAKE			
Lime/Bio-Mass	3,300	0.1	Landfill
Tin Mill Treatment Plant	15,800	0.6	Landfill
SCALE			
Rolling Mills	84,700	3.1	Sinter/BF
SLUDGE & FILTER CAKE			
Q-BOP	15,200	0.6	Sinter
TOTAL		10.0	Landfill

* Taken from EPA study entitled "Managing and Disposing of Residues from Environmental Control Facilities in the Steel Industry" - 12-15-75.

** Q-BOP production of 2,500,000 tons/yr in 1975.

into railroad track hoppers at coal unloading stations Nos. 2, 3, and 4 (No. 1 has been dismantled). Normally, railroad cars are to be unloaded at No. 3 station. No. 2 station is to be used only as a standby for No. 3. Coal unloaded at No. 2 station cannot enter the new coal handling and preparation system but must be conveyed directly to coke batteries Nos. 5, 6, 7, 8 and 9 only. Coal unloaded at No. 4 station is conveyed directly to ground storage or via a pulverizer and then to ground storage. When reclaimed, this coal can be transferred to No. 2 station or to the reclamation system serving No. 2 station and the new coal preparation system.

Truck-hauled coal placed in ground storage can be reclaimed via mobile equipment and diverted to either the No. 2 station or to the new coal preparation system.

Railroad car receipts dropped into the track hoppers at the No. 3 station can be conveyed to the new 10,000-ton silos or can be diverted to ground storage for later reclamation.

High volatile coal is handled separately from medium volatile coal through first stage pulverization. Therefore, high volatile coal is diverted to two of the 10,000-ton capacity silos while medium volatile coal is diverted to the third silo.

Methane is evacuated from the top of each silo via an exhaust fan and duct system. There, the ventilation unit circulates the air avoiding a methane buildup. Each of the three 10,000-ton storage silos will employ baghouses with design mass emission rates of 1.003 lb/hr (0.02 g/scf) and design removal efficiencies of 98.5 percent. See Attachment I to Appendix A-2 of the Technical Support Document for the calculation of the emission rate and all subsequent emission rates in this section.

Each 10,000-ton silo discharge is provided with a pair of variable speed feeder belts. Only one belt in each pair can run at a time. Each of the three pairs is provided with a bag-type dust collector and each pair of feeder belts discharges to a conveyor which tranfers its load to first stage pulverizers (5 units). Dust generated in the pulverizer building is again collected by a bag-type dust collector with a design mass emission rate of 2.69 lb/hr

(0.02 g/scf) and a design removal efficiency of 98.5 percent. Once pulverized, the high and medium volatile coals are placed onto a common conveyor and carried to the mixer building. Again, a bag-type dust collector serves this building with a design mass emission rate of 0.725 lb/hr (0.02 g/scf) and a design removal efficiency of 98.5 percent. The high and medium volatile coals are thoroughly mixed. Oil is added for bulk density control if the coal mix is destined for use in batteries Nos. 5, 6, 7, 8 and 9. No oil addition is made if coal is destined for the preheat facility and No. 2 coke battery. When the coal leaves the mixer building, it is conveyed to a 100-ton bin from which it can be directed to batteries Nos. 5, 6, 7, 8 and 9 or to the new No. 2 battery. This bin is provided with a bag-type dust collector which has a design mass emission rate of 0.583 lb/hr (0.02 g/scf) with a design removal efficiency of 98.5 percent.

If the coal is to be diverted to No. 2 battery, it is conveyed to the top of a 3,500-ton capacity silo provided with a methane evacuation system. From the 3,500-ton silo, the coal flows onto one or the other of two variable speed feeder belts which discharges to a conveyor feeding the secondary pulverizers (2 units). A bag-type dust collector serves the equipment below the 3,500-ton silo as well as equipment in the secondary pulverizer building. The design mass emission for this process is 4.52 lb/hr (0.02 g/scf) with a design removal efficiency of 98.5 percent.

From the secondary pulverizer building, coal is conveyed to the preheat building as shown in Figure 3-4. The design mass emission rate for this process is 0.876 lb/hr (0.02 g/scf).

Coal Preheating. A coal preheating and charging system will be installed in conjunction with the No. 2 coke oven battery at Fairfield Works. In this system, pulverized, wet coal from the coal handling and preparation section will be preheated to approximately 450°F and conveyed hot to the 500-ton coal bin mounted above the No. 2 battery. The hot coal will then be withdrawn through rotary feeders from the 500-ton bin into fixed-position, pre-weighing

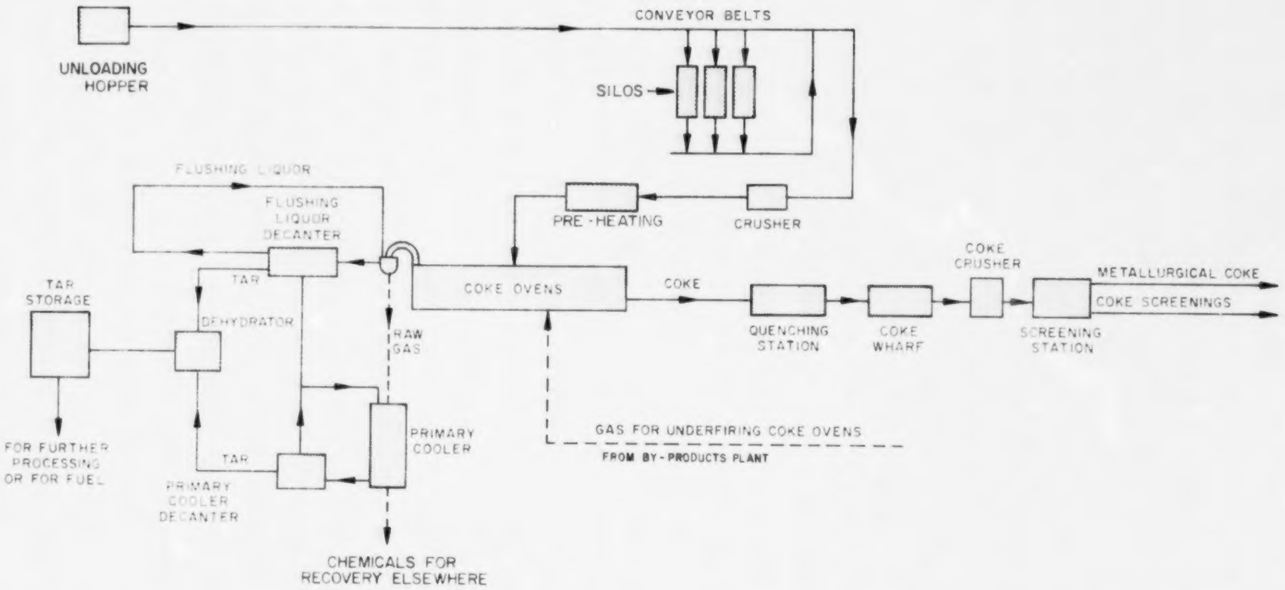

UNLOADING HOPPER
CONVEYOR BELTS
SILOS
FLUSHING LIQUOR
FLUSHING LIQUOR DECANTER
PRE-HEATING
CRUSHER
TAR
TAR STORAGE
DEHYDRATOR
COKE OVENS
COKE
RAW GAS
QUENCHING STATION
COKE WHARF
COKE CRUSHER
SCREENING STATION
METALLURGICAL COKE
COKE SCREENINGS
PRIMARY COOLER
GAS FOR UNDERFIRING COKE OVENS
FROM BY-PRODUCTS PLANT
FOR FURTHER PROCESSING OR FOR FUEL
TAR
PRIMARY COOLER DECANTER
CHEMICALS FOR RECOVERY ELSEWHERE

FIG. 3-4. FLOW SHEET SHOWING THE MAJOR STEPS INVOLVED IN THE PREHEATING AND CARBONIZATION OF COAL

hoppers which will hold the coal until the charging car moves into position below. The coal is then withdrawn from the hoppers via rotary feeders into a waiting coal charging car. When filled, the coal charging car then carries the preheated coal to the oven scheduled for charging. Preheating is accomplished in two identical lines of equipment at the rate of approximately 100 ton/hr-line. Coal dust emissions from each preheated coal premetering bin will be controlled by wet scrubbers with a total design mass emission rate of 0.0408 lb/hr (0.02 g/scf) and design removal efficiencies of 99.8 percent. (See Attachment I to Appendix A-2 of the Technical Support Document for the calculation of the emission rate).

Drying and heating of the coal in each line is carried out in a vertical duct into which coal is introduced by a controlled mechanical device. Coal is transported through the duct by a stream of high velocity flue gases which both heat the coal and transport it. This drying and heating medium of gases is produced in a highly efficient combustion chamber and forced through the system by a fan. A dry cyclone separator removes the coal particles from the carrier gas stream. Material collected in the cyclone is withdrawn via rotary valves into a chain conveyor for transfer to a mixer. From the mixer the hot coal is conveyed via a chain conveyor to the 500-ton bin above the No. 2 battery. When the carrier gas stream has passed through the final piece of equipment and the final process separation of coal and gas has been made, the carrier gas is then divided by controls into two streams--one for recycle to the system through the combustion chamber and the second stream, passing through a cleaning device, to the atmosphere. This stream is discharged vertically above the preheat building through a waste gas stack in conformance with environmental regulations.

The cleaning devices which will be used on each of the two preheat lines are variable venturi throat wet scrubbers, each having a design removal efficiency of 99.876 percent. The total design mass emission rate from both the preheat lines is 6.60 lb/hr (0.02 g/scf).

The coal preheating stack is characterized as follows:

Height above grade--220 ft (approximately)
Inside diameter at exit--3 ft, 5 in. (approximately)
Gas discharge rate (design rate)--9,850 scfm (dry)
Exit temperature--185°F (approximately)

A process schematic is presented in Figure 3-5. Particulates produced are estimated to be less than 30 lb/hr, allowed by the regulations. Assuming 0.5 percent sulfur in the coal, the SO_2 emission rate is estimated to be 98.6 lb/hr or 424 ton/yr. Calculations used to find the coal preheater emission rate for SO_2 and particulates are shown in Appendix A-5 of the Technical Support Document.

Coal Charging. Coal charging will be accomplished by a hot coal charging car ("hot" larry). After the larry car is filled at the coal line, it moves to an empty oven where it is discharged. This type of charging car will be the first of this particular design. While there are no emissions data specifically for stage charging, the system which will be installed is equivalent to good stage charging and is estimated to be approximately 95 percent effective compared to uncontrolled.

Coking. The coke oven is a refractory chamber with vertical flues where fuel gas is burned. Heat from combustion is transmitted to the coking chamber through the silica brick. The ovens are arranged side by side. The new battery will consist of 57 ovens. Coking chambers are rectangular in form, with an average height to the coal line of 19 ft, 2 in.; length of 47 ft, 7 in.; and an average width of 18 in. The chambers are air tight. Covering both ends of each chamber are tight-fitting doors which are removed for the discharge of coke. The heating walls, spaced between the coking chambers, are heated by the "half-divided oven" system. In this system a section of flues extends from each side along the length to the middle of the oven. Air and gas are introduced into one section of flues where combustion takes place and the hot exhaust gases pass down

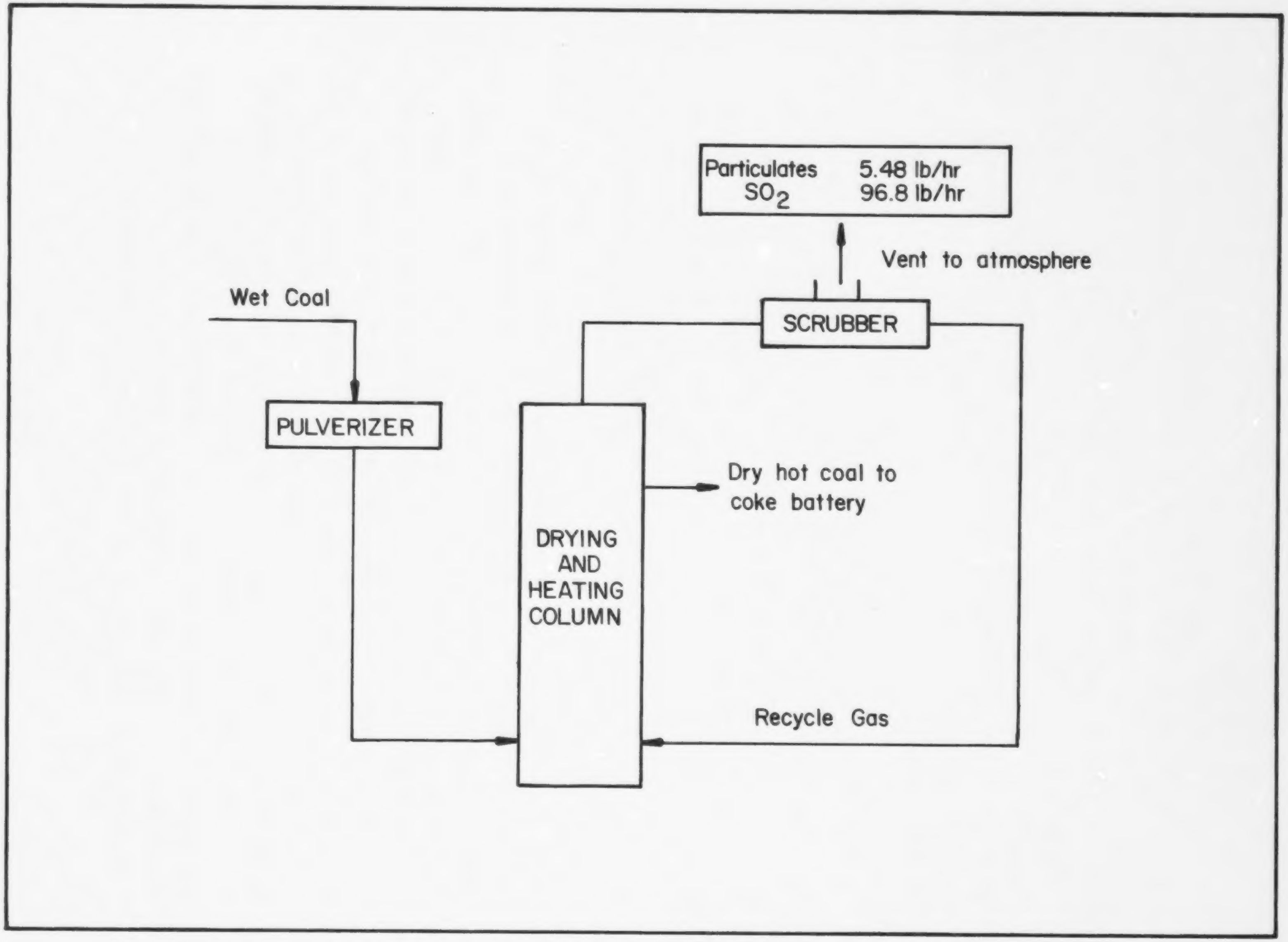

Particulates 5.48 lb/hr
SO2 96.8 lb/hr
Vent to atmosphere
Wet Coal
SCRUBBER
PULVERIZER
Dry hot coal to coke battery
DRYING AND HEATING COLUMN
Recycle Gas

FIG. 3-5. COAL PRE-HEATING SCHEMATIC FOR COKE BATTERY NO. 2

through the other section to the regenerators where the remaining heat is absorbed in the mass of brickwork under the ovens. Every 20 to 30 minutes the cycle is reversed and those flues which have been used for the exhaust become combustion flues. The necessary air for burning is pulled through the hot regenerative chamber, being preheated before it is mixed with the fuel gas. As the heat passes through the flue walls of the coking chambers, the coal begins to coke and fuse, and volatile gases are driven from it. Coking starts at the walls and proceeds inward, and the gases evolved pass outward through the partially coked mass, forcing their way to the top of the chamber. They are collected and pulled, with the gases collected from the other chambers in the battery, into a large collecting main from which they are withdrawn through a suitable pipe system and pass to various processing operations.

When the coke is ready for removal, a track-mounted door handling machine on each side of the battery moves to the oven to be emptied, and doors on both sides are removed. On the machine at the discharge side is a guiding device which, when placed in front of the oven, directs the coke into a quenching car waiting on a track below. The track-mounted machine on the opposite side is equipped with a ram of approximately the same proportions as those of the coking chamber. At a signal, the ram is forced into lumps as it falls into the quencher car. The coke at this point is at a temperature of about 2,000°F.

The coke is pushed into a closed coke quench car in which emissions will be contained and carried by induced draft for action through the inter-connecting duct work, the quencher, a variable throat wet scrubber, the moisture separator and induced draft fan stack. The quencher lowers the gas temperature while the scrubber cleans it. The scrubber water is dumped into a sump near the quench station and, following solids separation, clean water is recycled to the system.

The wet scrubber will remove coke fines with a design mass emission rate of less than 7.54 lb/hr (0.02 g/scf) as shown by the following calculation:

(44,000 scfm)(0.02 g/scf)(60 min/hr)/(7,000 g/lb) = 7.54 lb/hr

with a design removal efficiency of greater than 99.7 percent.

Coking Emissions. The following measures have been included in the design of this battery to minimize particulate emissions:

1. Hot coal charging car with sealing capabilities to prevent blow-back.
2. Mechanical gooseneck cleaners.
3. Mud-sealing oven lids and gooseneck lids.

Doors of an improved design will be tested at other U. S. Steel facilities to determine the most effective sealing edge in reducing emissions. The most effective design will be used for the Fairfield battery. The doors which will be installed will meet a ten percent door leakage standard.

The design data for the individual ovens are as follows:

1. Number of ovens--57
2. Average oven width--18 in.
3. Oven height--20 ft, 2 in.
4. Oven height to coal line--19 ft, 2 in.
5. Effective (coal) volume--1,374 cu ft
6. Oven length--47 ft, 7 in.

Characteristics for the underfiring stack are:

1. Height above grade--350 ft
2. Inside diameter at exit--16 ft, 9 in.
3. Gas temperature at exit--500°F
4. Gas velocity at exit--660 ft/min
5. Emissions (see Figure 3-6) particulates in gas--94 tons/yr or 21.46 lb/hr
6. Emissions (see Figure 3-6) SO_2 assuming 0.5 percent sulfur in gas--454 lb/hr or 1,987 ton/yr

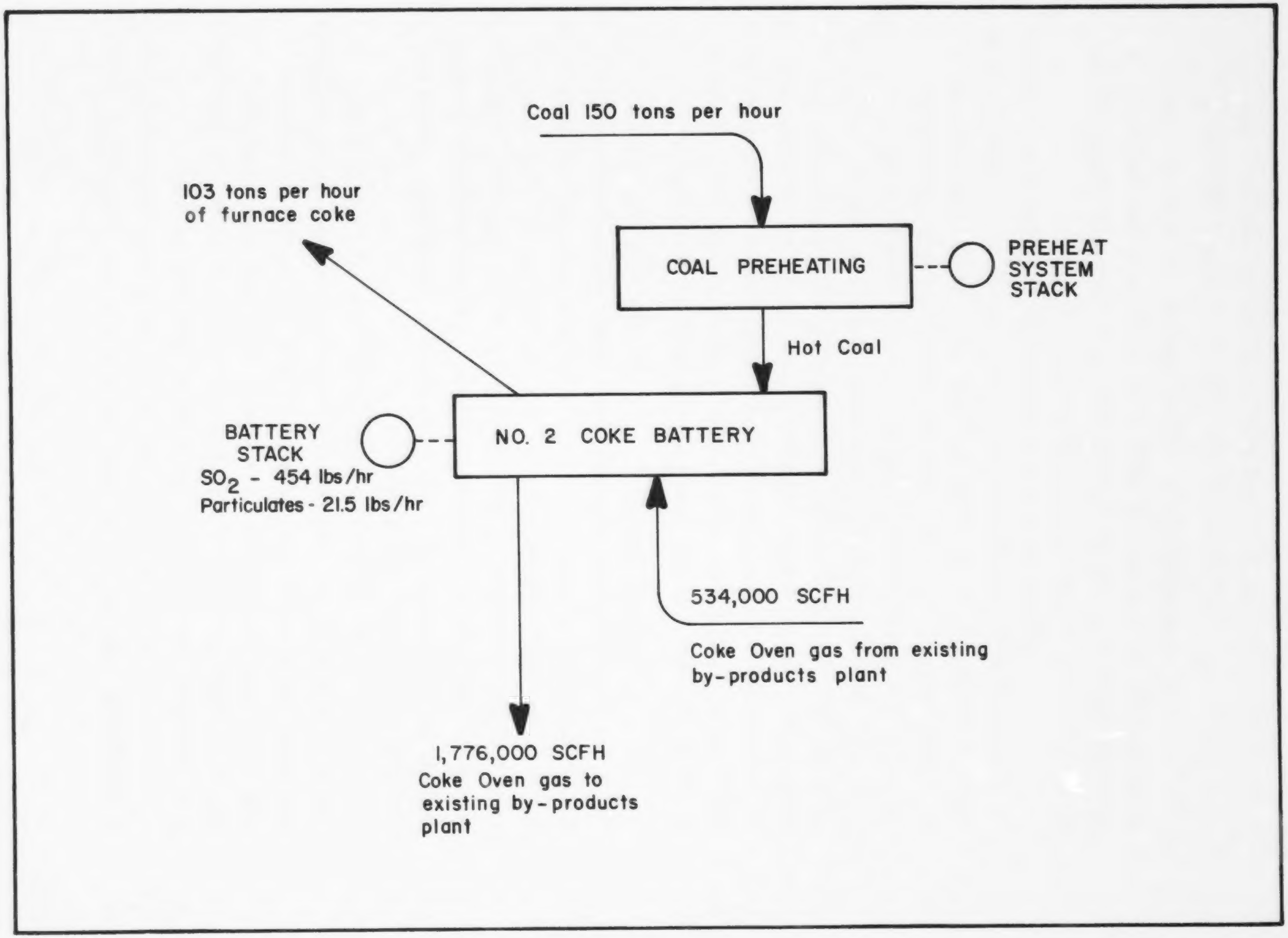

Coal 150 tons per hour
COAL PREHEATING
PREHEAT SYSTEM STACK
Hot Coal
103 tons per hour of furnace coke
NO. 2 COKE BATTERY
BATTERY STACK
SO_2 - 454 lbs/hr
Particulates - 21.5 lbs/hr
534,000 SCFH
Coke Oven gas from existing by-products plant
1,776,000 SCFH
Coke Oven gas to existing by-products plant

FIG. 3-6. COKE BATTERY PLUS PRE-HEAT SCHEMATIC

7. Calculations used to determine emissions for particulates and SO_2 are given in Appendix A-5.

Quenching. After being loaded, the quencher car is moved quickly to a quenching station at the end of the battery. Emission control at the quenching station is achieved using baffles to minimize the emissions of particulate matter.

The quencher car is then moved from the quench station to the coke wharf where the coke is discharged onto the wharf. After cooling on the wharf, the coke is raked at a controlled rate onto a belt and conveyed to a three-inch stationary screen. Oversized material from the stationary screen passes through a crusher to assure that all coke is reduced to a size less than three inches. All coke is then transferred via chute to a conveyor which transports the material to the No. 8 blast furnace stockhouse or to railroad cars. Emission control at the coke transfer building will be accomplished utilizing a baghouse with a design mass emission rate of 1.44 lb/hr (0.02 g/scf) and a design removal efficiency of 98.5 percent.

Coke By-Product Plant. The new coke battery at Fairfield Works will not increase the overall coke-making capacity. As a result, emissions at the by-product plant will not increase. The calculations used to determine particulate emissions, 0.875 ton/yr, are given in Attachment II to Appendix A-2 in the Technical Support Document. By-products recovered from the coal carbonization process include coke oven gas, tar, ammonium sulfate, light oil, naphthalene, creosote, pitch, and coke breeze.

The principal equipment consists of coal handling facilities, coke ovens, primary and final gas coolers, turbo-exhausters and turbo-boosters for gas, ammonia saturator, benzene scrubbers, light oil separating stills, wastewater treatment plant, ammonia stills, a fuel gas distribution system, and pitch plant. A detailed description of the processes using this equipment follows:

Gas released during the coking process passes from the ovens through standpipes into gas collector mains. The temperature of the gas is reduced in the collector mains from approximately 1,200°F to around 175°F by flushing liquor sprays in the mains. As the gas cools, the tar condenses out and drains by gravity along the bottom of mains to the tar flushing tanks. After the tar and weak liquor is dropped out in the trap and drain leg, the gas bypasses the flushing tanks and goes to the primary coolers.

There are three flushing tanks for batteries 5, 6, 7, 8, and 9. These tanks receive the flushing liquor and tar from the collector mains and decant (separate by gravity) the tars from the liquor. The bottoms (settled tar) are pumped to storage and the liquor is recirculated to the batteries. Surplus liquor is fed to ammonia stills for recovery of ammonia.

Raw coke oven gas, under the suction of the exhausters, passes through 18 primary gas coolers. The coolers are of the shell and tube, multipass, counter-flow type and use water as the cooling medium. In passing through the units, gas is cooled to approximately 95°F, thereby condensing the entrained water and tar, which are drained through seals to a sump and pumped to a tank for gravity separation. The tar is then pumped to storage tanks for further dehydration by steam heating.

Leaving the primary gas coolers, the gas passes to the turbo-gas exhausters, from which it is driven at a positive pressure of 40 ounces per square inch through the remaining recovery apparatus. These facilities comprise seven turbo-gas exhausters, driven by steam turbines.

Gas discharged from the exhausters is passed through a baffled tar precipitator for the removal of the last traces of entrained tar; thence through reheaters and saturator for recovery of the ammonia content. The saturator is a stainless steel vessel within which a solution of weak sulfuric acid is sprayed in direct contact with the coke oven gas. The ammonia content of the gas combines with the acid and forms ammonium sulfate, a crystalline salt, which is precipitated and collected in a crystallizer, from which it is pumped to a slurry tank and dried by centrifugal driers. The dried salt, containing in excess of 25 percent NH_3, is conveyed by pneumatic tube to the sulfate storage building. From storage it is loaded into railroad cars for shipment to the customer.

As the gas, free of ammonia, leaves the saturators, the remaining acid is removed by an acid separator adjacent to the saturator. From the neutralizer the gas is forced to the final coolers. There are five gas coolers which employ the direct cooling method.

The gas enters the bottom of the coolers and flows upward to pipes at the top. Water, sprayed from the top of the coolers, comes in direct contact with the gas and washes or pecipitates out the crude naphthalene. The crude naphthalene water flows continuously from the coolers to the naphthalene recovery area.

The effluent water, containing naphthalene, is directed to the naphthalene flotation cells. In these cells, rotating skimmers rake the floating naphthalene in the water. The recovered naphthalene flows to a sump and is allowed to rise to the top of the remaining water. After the naphthalene has accumulated on top, steam coils melt it so it can be pumped to drying tanks.

The naphthalene is allowed to dry in these tanks to insure that only a small amount of water remains. This crude naphthalene is then ready for shipment to the tar plant.

From the final gas coolers the gas, now free of tar, ammonia and naphthalene, flows to the scrubbers where the benzene products are removed. All the gas from the coolers enters No. 4 scrubber. As the gas leaves No. 4 scrubber, it is split. One-half goes to Nos. 3, 2, and 1 scrubbers and the rest goes to 5, 6, and 7.

The gas enters the base of each scrubber and as it flows upward to exhaust pipes, absorbent or wash oil is sprayed from the top. These wash oil sprays wash the benzene products from the gas. The oil is recirculated through the scrubbers until it absorbs a considerable amount of the benzene products. It is then pumped to the light oil still building for distillation.

The benzolized oil passes through a heat exchanger and then to the light oil still column. The benzolized oil enters the top of the still and comes in contact with the steam as it passes downward. The steam separates the light oil from the wash oil and carries it, as a vapor, back up through each tray section. After passing through the series of trays, the vapors enter a heat exchanger where much of the heat is absorbed by the incoming wash oil.

The partially cooled vapors leave the heat exchangers and are cooled in a dephlegmator. The secondary oil and water condensing in the dephlegmator are drained to the secondary oil decanter tank where they are recovered. The primary light oil vapors enter a condenser where they are cooled with water. The primary light oil and water enter another decanter tank where they are separated with the light oil going to a storage tank. From this tank oil is trucked to Port Birmingham for shipment to Clairton Works.

The debenzolized wash oil is cooled in spiral heat exchangers and piped back to the scrubbers to be used again.

The gas which was routed through Nos. 1, 2, 3, 4, 5, 6, and 7 scrubbers is routed back to the batteries to be used for heating ovens and constant pressure of 15 in. of H_2O is maintained by two gas holders. A steam driven gas booster pumps the gas from the low pressure system and compresses it to approximately 4.3 lb. The booster gas is piped to Ensley, Fairfield Steel, or to the Fairfield Tin Mill.

The pitch plant is designed to process continuously a maximum of 80,000 gallons per day of heavy tar recovered primarily from the hydraulic mains of the batteries.

Major equipment of the pitch plant consists of a crude tar feed tank, natural gas-fired heater, tar flash tank, chemical oil shell and tube condensers, pitch storage tanks, chemical oil storage tanks, pitch upgrading unit, a hot oil heating system for the pitch storage tanks and a thermal electric heating system.

The pitch plant is designed for the continuous distillation of heavy tar into chemical oil and specification electrode pitch.

The above equipment and tanks vent to the atmosphere. The last survey made of the by-products plant was in December, 1977, when Research Triangle Institute contracted with EPA to do a study on the verification of priority pollutants.

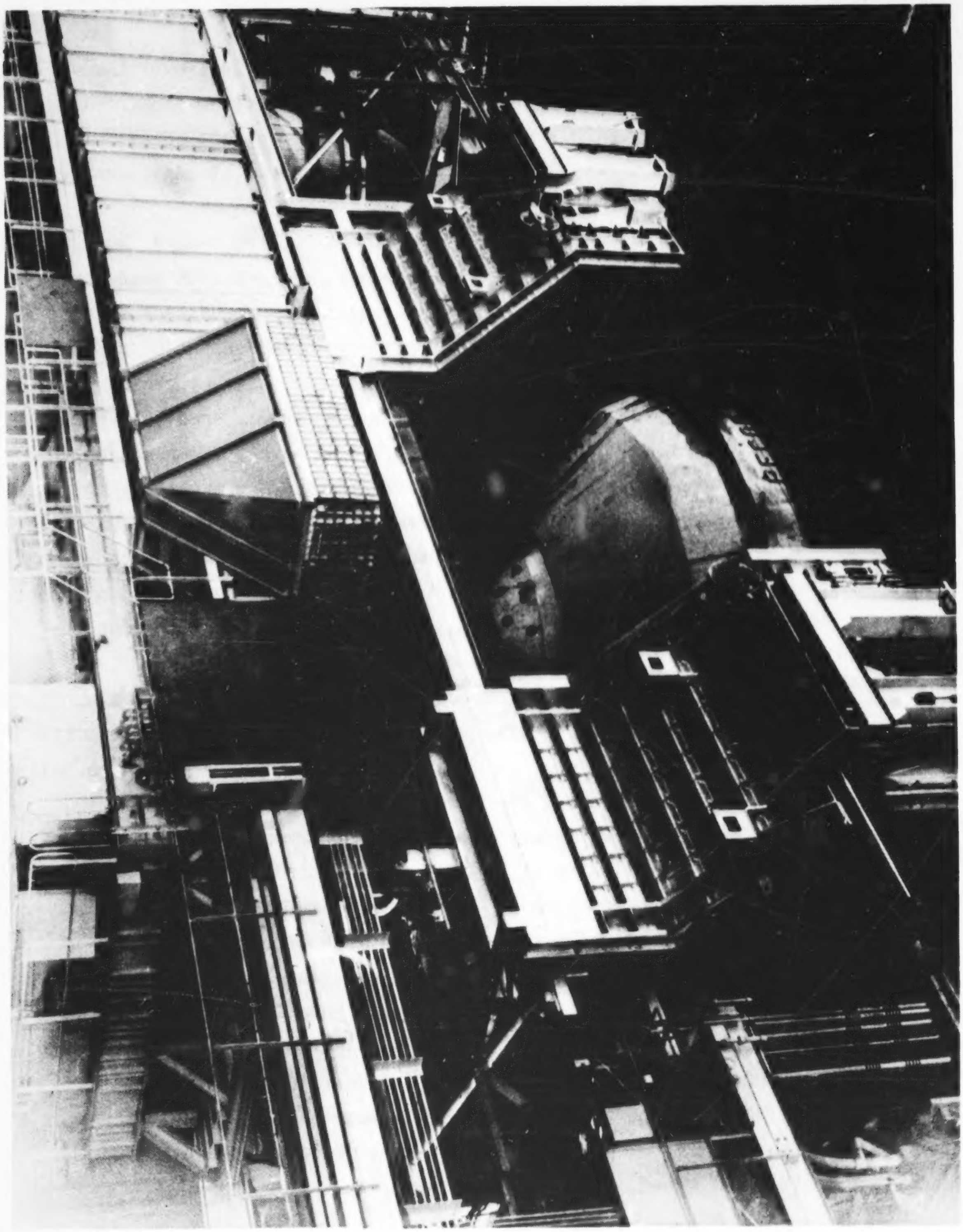
3.1.2.2. Process Effluents

Separate facilities will be required for the tar and flushing liquor system, such as separating predecanters and decanters. Flushing liquor and tar transfer pumps will be furnished, as will tanks for flushing liquor surge and tar transfer. An existing biological treatment unit has the capability to treat effluents from the new No. 2 coke battery.

3.1.2.3. Third Q-BOP Furnace

An additional Q-BOP furnace is scheduled to replace steelmaking capacity lost at Ensley with the closing of the open hearth furnaces at that facility. Completion of this Q-BOP furnace will allow U. S. Steel Corporation to maintain its 3.5 million ingot ton/yr steelmaking capacity at Fairfield Works. The third Q-BOP will be located in the same building as the other two Q-BOP furnaces.

Method of Operation. The basic oxygen furnace used in the Q-BOP process is shown in Figure 3-7. The barrel-shaped furnace is mounted on trunnions. These enable it to rotate completely about a horizontal axis. The bottom of the Q-BOP is equipped with a series of tuyeres for oxygen injection. The furnace further consists of a middle cylindrical section called the barrel, and a cone section that tapers concentrically to a nose or mouth at the top. Located in the lower section of the cone is a tap-hole which separates the steel from the slag during the tap. A refractory brick lining protects the steel shell from erosion.



PHOTOGRAPH OF AN EXISTING Q-BOP.

A gas-collecting hood is installed just over the mouth of the furnace in its vertical position. The charging side of the furnace is fitted with a separate enclosure during all phases of operations except during charging of scrap, hot metal additions, and sampling.

In operation, the furnace is rotated toward the charging side and, after opening the shielded doors, charged with predetermined weights of scrap and hot metal. This limits the amounts of scrap that can be melted. Charges usually range from 70 to 86 percent hot metal, the balance consisting of various scrap mixes. While charging the furnace, low pressure nitrogen is blown through the tuyeres; however, immediately prior to rotating the furnace to a vertical position, a high pressure gas is blown through the tuyeres to prevent any metal from flowing into the tuyeres and the refining of iron to steel commences. Lime is injected with oxygen on a programmed basis to maximize the removal of phosphorus and sulfur while using a minimum amount of lime. The oxygen and lime impinge directly into and through the bath, which greatly contributes to a positive physical as well as chemical interchange. During the blow, other fluxes such as fluorspar and limestone can also be injected with the oxygen through the bottom. When the programmed amount of oxygen and lime has been blown, normally 10 to 13 min in duration, the furnace is turned down and the oxygen flow switched to low and any adjustment to carbon and/or temperature can be made by reblowing or by adding additional fluxes, or both. When the steel composition and the temperature are as required, the furnace is tapped, utilizing either the taphole or lip tapping.

When the steel has completely drained into the tapping ladle and a thin insulating layer of slag covers the heat, the furnace is rotated to allow the remaining slag to be dumped into a slag pot positioned on a transfer car. The furnace is then positioned to receive the charge for the next heat. Meanwhile, the ladle transfer car has been moved into the teeming area where a crane picks up the ladle and proceeds to teem the steel.

All Q-BOP furnaces at Fairfield Works (two existing and one new) will be equipped with improved water cooled doors and improved labyrinth seals will be installed. An additional baghouse will be utilized to handle secondary emissions. In addition, a secondary hood system will be installed on the inside of the "doghouse" of each furnace which will exhaust at a larger rate.

Blowing, charging, and tapping operations at each furnace generate waste gases which are collected in a closed-system, water-cooled hood and directed into a variable venturi primary and secondary wet scrubber before being exhausted to a flare stack where non-combusted gases are burned prior to discharge into the atmosphere. Dust concentrations in the emission are maintained at less than 0.02 grains per standard cubic foot for the two existing vessels and will be 0.01 grains per standard cubic foot for the new vessel. Sludge collected from the dual venturi system is transported to a dump site. Recovered water is recirculated in the gas cleaning system.

Each furnace is provided with a transfer car track to carry two power-driven transfer cars: one a 210-ton teeming ladle, and the other a 500-cubic foot slag pot. A mobile carrier removes the filled slag pot for disposal and replaces it with an empty slag pot for each heat.

Emissions Process. During the blow, large quantities of gas, principally carbon monoxide and carbon dioxide, and lesser amounts of iron oxide fume and lime dust, are released from the bath. These gases are pulled up into the water-cooled collecting hood by induced draft fans located at the back end of the gas cleaning system.

The Q-BOP is a partial combustion system where the opening at the furnace mouth is restricted, thus limiting the heat generated by burning gases and permitting collection of gas which is flared to the atmosphere. In addition the partial combustion system results in a minimum quantity of gas being exhausted thus limiting the total quantity of particulate matter being emitted.

Limestone and other fluxing agents are transported in pulverized form through pneumatic conveying systems. Dust from the transport systems is collected in bag filters and recycled into the process.

Emission control at the limestone truck unloading area will be accomplished using a baghouse with a design mass emission rate of 0.198 lb/hr:

(9.250 scfm)(.0025 g/scf)(60 min/hr)/(7000 g/lb) = 0.198 lb/hr

and a design removal efficiency of 99.9 percent.

The gases produced are carbon monoxide and carbon dioxide with finely divided iron oxide particles. These gases issue from the furnace mouth and are collected in a water-cooled hood. They are then removed in a venturi scrubber. The gas exhaust and cleaning system will function independently of each of the other two Q-BOP's. Figure 3-8 is a schematic of the process.

The carbon monoxide is ignited and burned to carbon dioxide at the top of the stack. The estimated quantity of carbon monoxide gas ignited at this location is approximately 81,000 scfm at an exit velocity of 105 ft/sec. The mass emission rate is

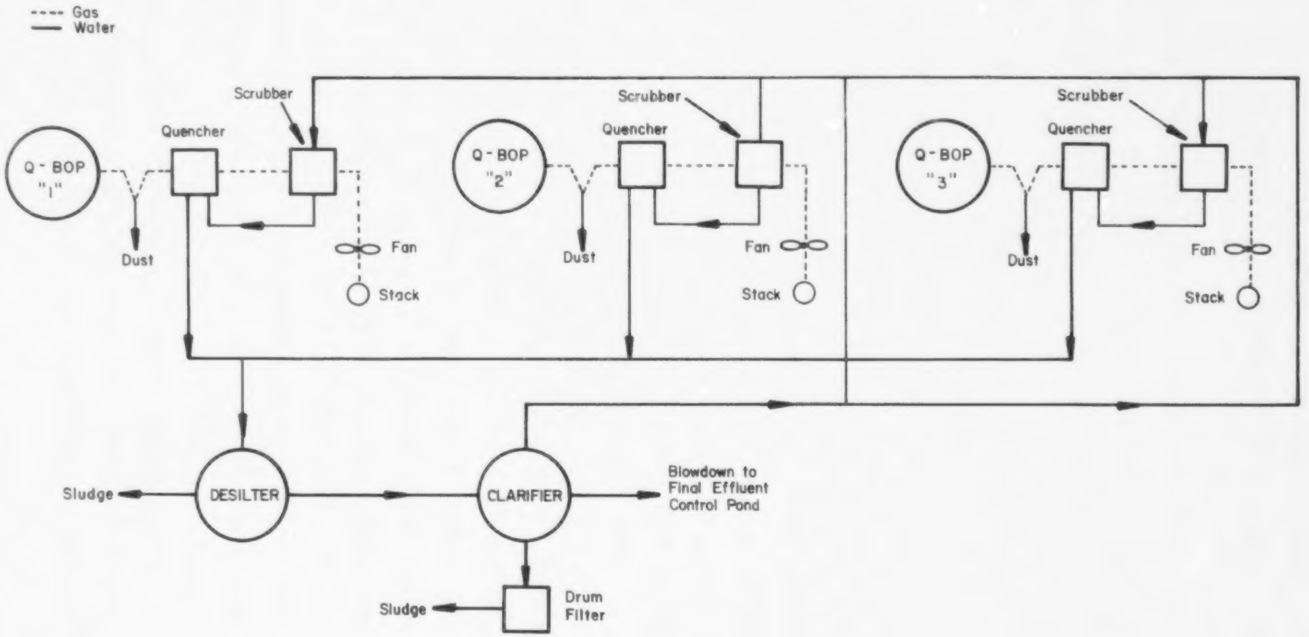
(.0081 lb/ton)(3,500,000 ton/yr)/(2,000 lb/ton) = 14.1 ton/yr

Therefore the amount of iron oxide dust entrained in this gas is designed to be no more than 3.2 lb/hr or 14.1 ton/yr.

The dust particles removed in the scrubber are settled out of the scrubber water in a thickener and the sludge is filtered in a vacuum filter and is taken to a landfill. Process slag is impounded for future reclamation.

The clarified water, less the blowdown for dissolved solids control, is recycled to the process. The maximum make-up water required for the unit will be 200 gpm.

3.1.3. Operations Changes



---- Gas
—— Water
Q - BOP "1"
Q - BOP "2"
Q - BOP "3"
Quencher
Scrubber
Dust
Fan
Stack
DESILTER
CLARIFIER
Sludge
Blowdown to Final Effluent Control Pond
Drum Filter
Sludge

FIG. 3-8. FINAL THREE Q-BOP GAS CLEANING SYSTEM AT FAIRFIELD

3.1.3.1. Changes in Fairfield Operation

In order to maintain the existing 3.5 million ingot tons per year capacity and to be in compliance with air emission implementation plans, the following changes in Fairfield operations are anticipated.

1. Installation of a third Q-BOP furnace.
2. Installation of a modern 57-oven coke battery including coal preheating and coal handling facilities.
3. Installation of blast furnace (No. 8) and auxiliaries.
4. Provision of four additional soaking pits.
5. Idling of old coke batteries (Nos. 3, 4, 7, and 8).

Coke batteries Nos. 3 and 4 which are the oldest batteries at Fairfield Works, will be dismantled approximately three months prior to and No. 8 retired immediately prior to commencement of operation of the new coke battery No. 2. Coke battery No. 7 will continue to operate until the end of its economic life.

These changes at Fairfield will continue existing coking capability at Fairfield, and replace existing blast furnace operations at Ensley which will also restore lost Ensley steelmaking capability caused by shutting down of the uncontrolled open hearth furnaces. Reliable operation of No. 8 blast furnace at design specifications will permit phase-out of Ensley Blast Furnaces 1, 2, and 3 and result in increased iron production above pre-1972 capabilities of 602,900 ton/yr.

At the 3.5 million ingot ton per year production capacity, the screening and sinter operations at Wenonah operate at full capacity. This operational status will not change with the new facilities.

Third Q-BOP. The third Q-BOP furnace will allow the required maintenance to ensure that the two Q-BOP shop will consistently produce the 3.5 million ingot ton capacity for which the shop was designed. Treatment facilities existing at this shop were designed for the operational capacity of 3.5 million ingot tons yearly production and will not change. Oxygen supply facilities will prevent simultaneous operation of all three Q-BOP furnaces at any time. Consistent operation of the Q-BOP shop with implementation of Blast Furnace No. 8 will increase the effluent from this facility from 1.0 mgd to 1.3 mgd to the final effluent control pond.

Coke Battery No. 2. The long-range program to replace four old coke batteries with a new modern coke oven battery will not result in added effluent discharge from the Coke Plant.

3.1.3.2. Changes in Ensley Operations

Cessation of operations of the blast furnaces at Ensley will cause substantial reductions in the wastestreams entering Village Creek. Flow from Outfalls 002, 003, 004, and 005, which consisted of water cooling operations and blowdowns, will be decreased an estimated 9.9 mgd. The flow from Outfall 003, which comes from the cooling towers, will continue at a reduced flow since the cooling towers will be required for remaining Ensley operations. Flow from Outfalls 002 and 004 will cease with the closing of the three blast furnaces.

3.1.4. Meteorology and Climatology

3.1.4.1. General

The climate of the Jefferson County area is temperate and continental with relatively short moderate winters and long warm summers.

For the period of record, Jefferson County's monthly temperatures show a range from a January mean of 44°F to a July mean of 80°F. This 36°F annual range reflects (a) the effect of the station's location with respect to the Gulf of Mexico to the south and (b) the invasions of relatively cold air from the continental north and west.

The Jefferson County area receives an average annual rainfall of 55 in. Precipitation has two maxima each year, one during the winter months, and another, slightly lower, in July with a minimum occurring during October. The greatest chance of flooding occurs in the winter and early spring (December through March) when frequent migratory storms bring general rains of high intensity. The second peak occurs in July, in the form of conventional thunderstorms, during the growing season. The maximum monthly snowfall of 11.8 in. occurred in January of 1936, with 11.0 in. occurring in a single 24-hr period. Historically, however, snowfall is seldom heavy enough to be important. The geographic location keeps Jefferson County safe from the destructive winds of hurricanes but not from tornadoes. During the period from 1930 to 1974 only one violent tornado (NOAA class F4 or F5) touched down in Jefferson County and five strong tornadoes (classes F2 and F3) occurred.

The location of the county's industrial belt, prevailing southwesterly-northeasterly wind from June through November, and Red Mountain have encouraged temperature inversions and hindered the dispersion of industrial and other air pollutants generated within Jones and Opossum Valleys. Under clear skies and light winds a ground radiation fog forms in these valley locations often. An inversion layer forms directly above the fog but below this inversion layer pollutants are emitted into an originally stable layer within the fog and are brought to the ground in relatively high concentrations. Under optimal conditions as a part of diurnal cycle such fogs can persist for days in the valley, maintaining a lid to vertical dispersion.

3.1.4.2. Ambient Air Quality

A review of the data developed by the end of 1977 indicates that Jefferson County's primary air quality problem is suspended particulate matter in the atmosphere and photochemical oxidants. The areas with the highest total suspended particulates (TSP) concentrations center around the North Birmingham-Tarrant City area as well as much of the Leeds area. However, the Fairfield air quality sampling station nearest to the Fairfield Works meets the primary ambient air quality standards for particulate matter. Jefferson County has recommended that the more intensive developments including industrial, commercial, and residential land uses be encouraged within "cleaner" areas. In addition to particulates, other pollutants currently measured in Jefferson County include sulfur dioxide, carbon monoxide, nitrogen dioxide, and total nonmethane hydrocarbons, all of which meet Ambient Air Quality Standards according to the Jefferson County Board of Health.

General trends over the past four years (1971-1975) indicate that there have been substantial reductions in both total and point source emissions. The total point source emissions in 1971 were 151,321 tons per year which is 93.5 percent of the total emissions, but by 1975 there was a 62 percent reduction achieved and the point source emissions were down to 57,180 tons per year.* It was evident from the data provided by Jefferson County that these reductions in total point source emissions were still continuing in the years 1976 and 1977, but the running averages of TSP obtained at the Jefferson County monitoring stations are not significantly different than the Air Quality Standards in 1977. To obtain a plan for attainment for 1977 and maintenance of air quality standards in Jefferson County both the state and county programs have been assigned tasks to analyze and define the additional control requirements necessary to achieve the Federal Air Quality Standards.

As a result of the measured violations of Federal Primary Ambient Air Quality Standards for TSP in some areas of Jefferson County, and photochemical oxidants, the U. S. Environmental Protection Agency designated the entire county as a non-attainment area and thus the schedule established by the State is for the development of non-attainment SIP revisions.

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*Annual Progress Report of Jefferson County Health Department, October 1975 - September 1976.

3.1.5. Topography and Geography

3.1.5.1. Plant Site Location

The plant site is located in southwestern Jefferson County, Alabama. Jefferson County, Alabama, with the City of Birmingham as its principal urban center, is situated within a geologically complex terrain. The topography of the county imposes natural controls upon land use and will continue to do so in the future. Urbanization in and surrounding the City of Birmingham has taken place where these natural controls are not so restrictive. Elsewhere the parallel northeast-trending ridges and valleys tend to guide and even restrict development to a linear pattern.

To the south and east of the plant site lies Red Mountain (elevation 950 ft). To the north of the plant site lies Sand Mountain (elevation 700 ft). Between the Red Mountain and Sand Mountain formations lie Jones and Opossum Valleys. These valleys are in turn divided by a low ridge known as Enon Ridge or West Red Mountain to the northeast and Flint Ridge to the southwest. Opossum Valley is also known as Pinson Valley in its northeasterly extremity. Both Jones and Opossum Valleys are wide, flat bottomed valleys.

Elevations within Opossum Valley range from 500 to 540 ft. near the project site. The valley is about one mile wide in this vicinity. Located to the immediate southeast of Opossum Valley, over Flint Ridge in the larger Jones Valley is much of the City of Birmingham. Jones Valley, approximately 8 miles in length, ranges from 2 to 4 miles in width.

3.1.5.2. Drainage Patterns

The drainage patterns of the streams of the Jefferson County vary with the underlying geologic provinces. Drainage patterns in the Cumberland Plateau section in the western part of the county are dendritic in form.

In the Valley and Ridge province in the eastern half of the county drainage follows the trellis pattern of flow. To the northwest of the Opossum Valley plant site the topography is generally of moderate relief and representative of the Cumberland Plateau. It is sparsely populated with development generally restricted to the upland areas as the low order streams occur in gorgelike and heavily tree-lined valley sections.

Three principal streams are potentially affected by the proposed action within Jefferson County. These streams are Village, Valley, and the Locust Fork of the Warrior River, Figure 3-9. The headwaters of Village and Valley are within the metropolitan boundary of Birmingham and adjacent urbanized communities. Urbanization, therefore, has some effect on these streams. Extensive development has taken place and is continuing on the flood plains along these two streams. Development is primarily through encroachment into the flood plains by filling with materials from grading operations for new commercial and industrial building sites, highways, and residential development adjacent to the flood plains.

Valley Creek flows southeasterly through Jones Valley receiving the flow of Opossum Creek draining the southwestern part of Opossum Valley. Valley Creek, at a point west of Bessemer, then sweeps westerly to the Warrior River. These two streams drain the parallel Opossum and Jones Valleys. Each follows the trellis pattern. The trellis stream system form can be characterized by a modified dendritic (finger-like) configuration with parallel tributaries and short parallel gullies at perpendicular angles. The pattern is indicative of the underlying bedrock structure, which is tilted interbedded, sedimentary rock in which the parallel channels follow the strike of the beds.

For Valley Creek the length of the study reach included is about 29 miles and drains about 85 square miles. Streambed slopes average about 10 feet per mile with maximum slopes of approximately 20 ft/mile. Characteristics of the basin include steep to gently rolling topography. Urban development (industrial, commercial, and residential) has occurred primarily within the upper miles of the reach. The main channel has been partially modified by channelization

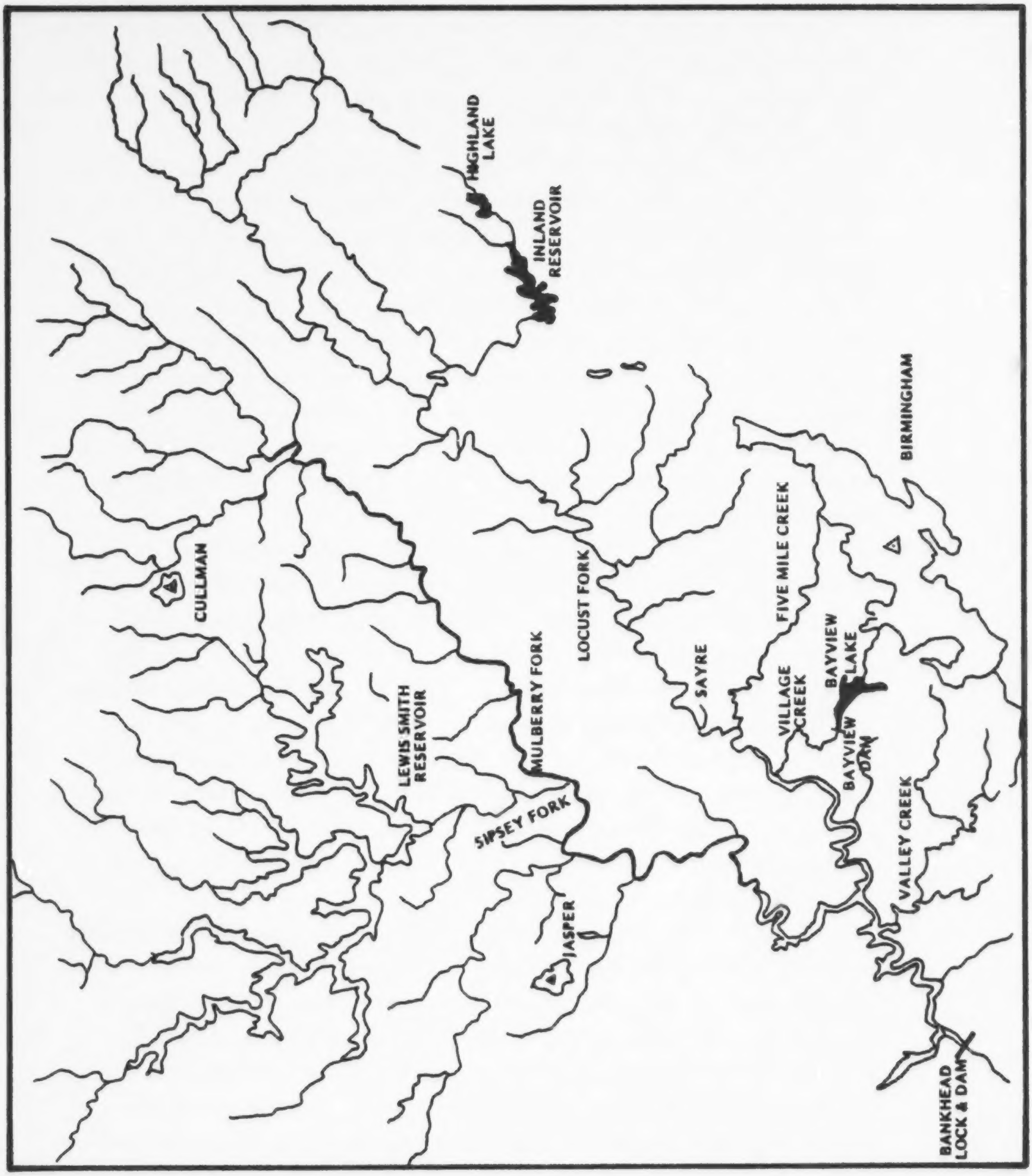

HIGHLAND LAKE
INLAND RESERVOIR
BIRMINGHAM
FIVE MILE CREEK
LOCUST FORK
CULLMAN
MULBERRY FORK
LEWIS SMITH RESERVOIR
SAYRE
VILLAGE CREEK
BAYVIEW LAKE
BAYVIEW DAM
VALLEY CREEK
SIPSEY FORK
JASPER
BANKHEAD LOCK & DAM

FIG. 3-9. MAP OF WARRIOR RIVER DRAINAGE BASINS

and urban development and some overland drainage devices such as curbing, guttering, and storm sewering exist.

Village Creek flows southwesterly along the floor of the northeastern part of Opossum Valley to Ensley then runs westerly to the Warrior River. Five Mile Creek flows westward from the Pinson Valley into the Warrior River. In addition, there are numerous other tributaries of these streams that follow this same generally westward flow. The creek locations are depicted in Figure 3-10 with the topographical map designations.

Slopes. The preceding discussion of topography provides an indication of the development problems posed by the predominant slope conditions in Jefferson County. Figure 3-11 reveals the areas within the county meeting different slope criteria. Areas having slopes ranging from 0 to 10 percent are suitable for most types of development and should be prime industrial development areas from the standpoint of this factor. Commercial, residential and agricultural development generally are suitable for areas having a 0 to 10 percent slope as well as 10 to 20 percent slope areas, but generally are not recommended for the areas exhibiting slopes in excess of 20 percent. Industrial development is generally not recommended for areas having slopes greater than 10 percent.

The relative proportions of Jefferson County falling into the various slope categories are shown in Tables 3-8 and 3-9. The areas of relatively level lands are concentrated in the Jones, Opossum, Pinson and Shades Valleys.

3.1.5.3. Erosion

The identification and subsequent control of critical erosion areas is of prime importance in any water quality management program. This is especially true in areas of urban development such as Opossum and Jones Valleys where soil erosion can increase to as much as 25,000 tons per year on a square mile of land. Areas subject to erosion in Jefferson County include most areas of sloping soils where the protective vegetation has been removed, such as cuts and

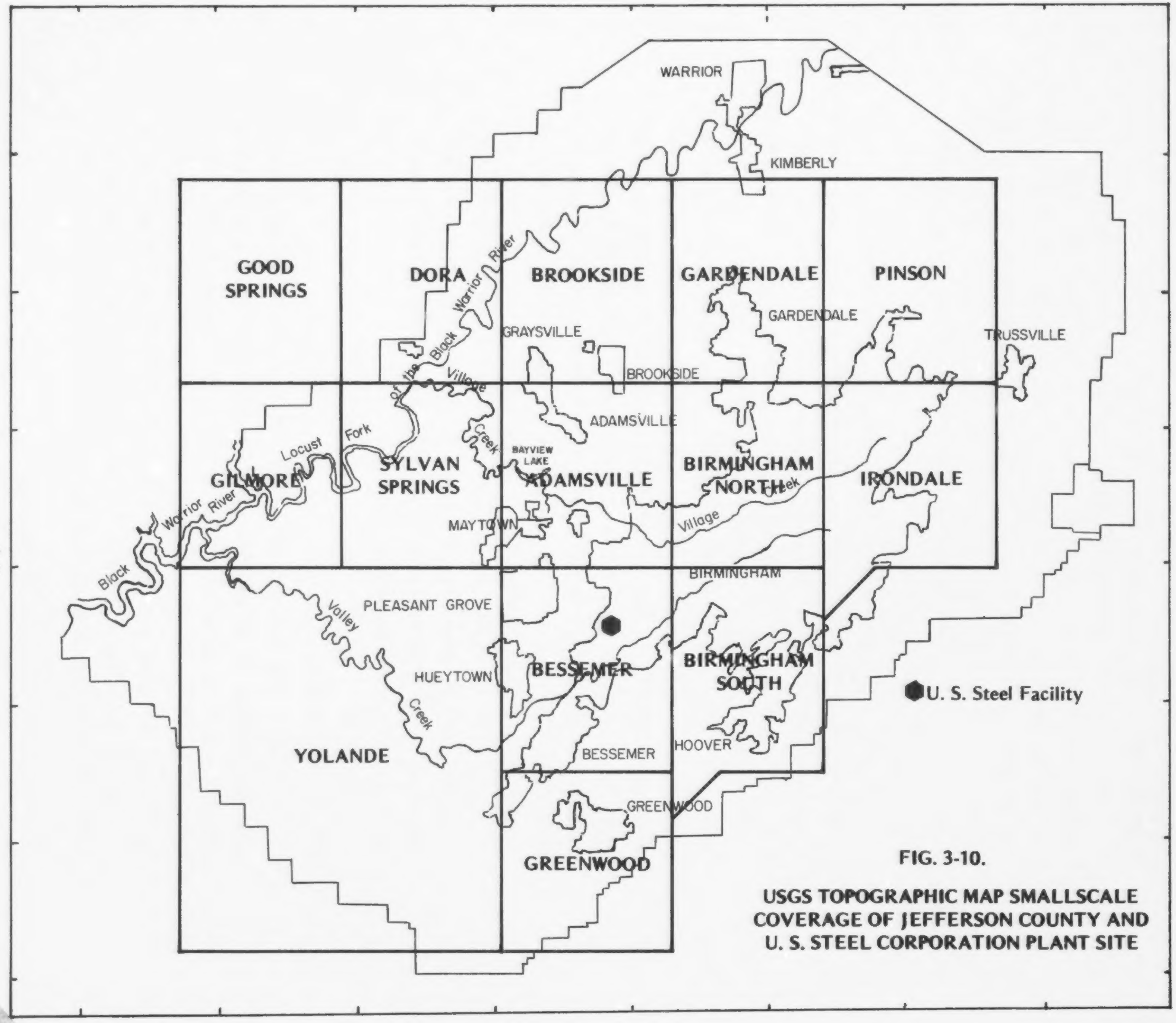
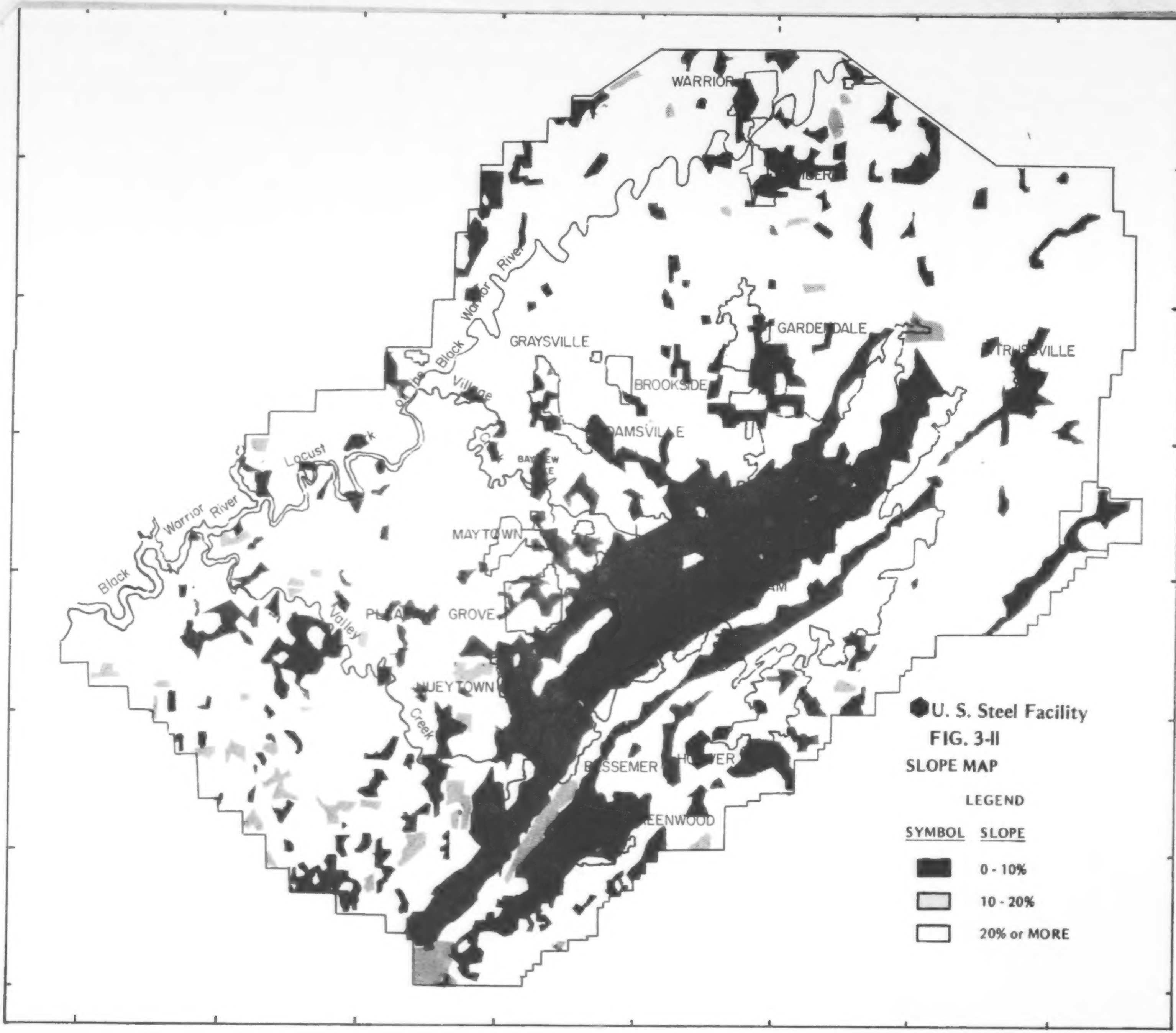

WARRIOR
KIMBERLY
GOOD SPRINGS
DORA
BROOKSIDE
GARDENDALE
PINSON
GARDENDALE
TRUSSVILLE
GRAYSVILLE
BROOKSIDE
Black Warrior River
of the
Village
ADAMSVILLE
Locust
Fork
Creek
BAYVIEW LAKE
GILMORE
SYLVAN SPRINGS
ADAMSVILLE
BIRMINGHAM NORTH
IRONDALE
Creek
Black
Warrior
River
MAYTOWN
Village
BIRMINGHAM
PLEASANT GROVE
Valley
HUEYTOWN
BESSEMER
BIRMINGHAM SOUTH
U. S. Steel Facility
Creek
YOLANDE
BESSEMER
HOOVER
GREENWOOD
GREENWOOD

FIG. 3-10.

USGS TOPOGRAPHIC MAP SMALLSCALE COVERAGE OF JEFFERSON COUNTY AND U. S. STEEL CORPORATION PLANT SITE


WARRIOR
GRAYSVILLE
BROOKSIDE
GARDE DALE
TR SVILLE
AMSVILLE
BAY EW
MAYTOWN
PL GROVE
UEYTOWN
BESSEMER
HO VER
EENWOOD
Black Warrior River
Village
Locust
Valley
Creek
LEGEND
SYMBOL SLOPE
0 - 10%
10 - 20%
20% or MORE

U. S. Steel Facility

FIG. 3-II

SLOPE MAP

TABLE 3-8

SLOPE CONSTRAINT AREAS

LAND USE	DEGREE OF SOIL LIMITATION DUE TO SLOPE		
	SLIGHT	MODERATE	SEVERE
Septic Tank Absorption Fields	0 - 8%	8 - 15%	More than 15%
Sewage Lagoons	Less than 2%	2 - 7%	More than 7%
Shallow Excavations	0 - 8%	8 - 15%	More than 15%
Dwellings	0 - 8%	8 - 15%	More than 15%
Sanitary Landfill	0 - 15%	15 - 25%	More than 25%
Local Roads and Streets	0 - 8%	8 - 15%	More than 15%
Road Fill	0 - 15%	15 - 25%	More than 25%

TABLE 3-9

SLOPE COVERAGE, JEFFERSON COUNTY, ALABAMA

AREAS	ACRES	SQUARE MILES	% OF COUNTY
0 - 10% Slope	246,297	384.8	47.8
10 - 20% Slope	112,827	175.2	16.4
20% Slope or More	328,852	515.0	35.8
TOTAL	687,976	1,075.0	100.0

fills, road banks, mining areas, as well as those areas undergoing development for subdivisions and industrial sites.

Areas with a high potential for erosion can be identified both by steepness of the slopes and the associated soil erodibility factors. These areas can be located by using technical data and soil maps available for the Jefferson County area. Each soil is assigned an erodibility factor. This factor, combined with the percent slope, gives a potential erosion value. This value can be used in determining those areas that need special care during site development to prevent severe erosion problems. These sites benefit from control measures such as quick revegetation, use of sediment basins, grassed waterways and other methods which reduce water velocity and trap sediment.

The site of the new blast furnace and associated facilities has been designed so that all storm water drainage passes through a final effluent control pond before release to Little and then Opossum Creek. Primary treatment in the Final Effluent Control Pond consists of sediment removal prior to release of storm water drainage from the plant confines.

3.1.5.4. Outcroppings - Mineral Resources

The Birmingham anticline is the major structural feature in the Fairfield Works area. It is a breached, asymmetrical anticline, trending northeast, and is underlain by limestone, shale, sandstone, chert, dolomite, and some iron ore seams. Rocks ranging in age from Cambrian to Pennsylvanian crop out in the Fairfield area. The Paleozoic sediments in the vicinity generally dip to the southeast except where folded or faulted.

3.1.6. Geology

Jefferson County, Alabama, lies partly in the Valley and Ridge province and partly in the Cumberland Plateau. The boundary between the two crosses the county on the northwest side of Opossum Valley and passes through the U. S. Steel Fairfield Works site.

3.1.6.1. Geologic Provinces

The Valley and Ridge Province. The Valley and Ridge province in Alabama represents the southern end of the great Appalachian Valley that extends northeastward to Canada. It slopes gnerally southwest and is drained by the Coosa and Cahaba Rivers and is shown in the series of northeasterly trending local subdivisions in Figure 3-12. Local subdivisions include the Weisner Ridges, Coosa Valley, Coosa Ridges, Cahaba Valley, Cahaba Ridges, and the Birmingham-Big Canoe Valley. The rocks of this region are sandstone, shale, limestone, and dolomite of Paleozoic age that have been strongly folded so that they lie in great arches* and troughs.** The distinguishing topographic feature of this province is the series of parallel ridges and valleys all having a northeast trend. The valley floors range in altitude from 500 to 900 feet and the ridges from 1,000 to 2,100 feet above sea level Cahaba Valley, lying between the Coosa Ridges and the Cahaba Ridges, extends for 75 miles northeastward across Bibb, Chilton, Shelby, Jefferson, and St. Clair Counties. The Birmingham-Big Canoe Valley, which lies west of the Cahaba Ridges, is an anticlinal limestone valley 4 to 8 miles wide that extends for 90 miles from Etowah County into Tuscaloosa County.

The Birmingham-Big Canoe Valley subdivision is divided into Opossum Valley on the northwest and Jones Valley on the southeast. Each part of the Birmingham Valley follows the crest of an anticline. They are separated by a low synclinal ridge, which becomes Blount Mountain, to the northeast.

Extending the length of Jefferson County on the east side of Jones Valley is Red Mountain, formed by the southeastward-dipping beds of the Red Mountain formation, which stand in a prominent northwestward-facing scarp conspicuous from any point in the Birmingham Valley.

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*anticlines
**synclines

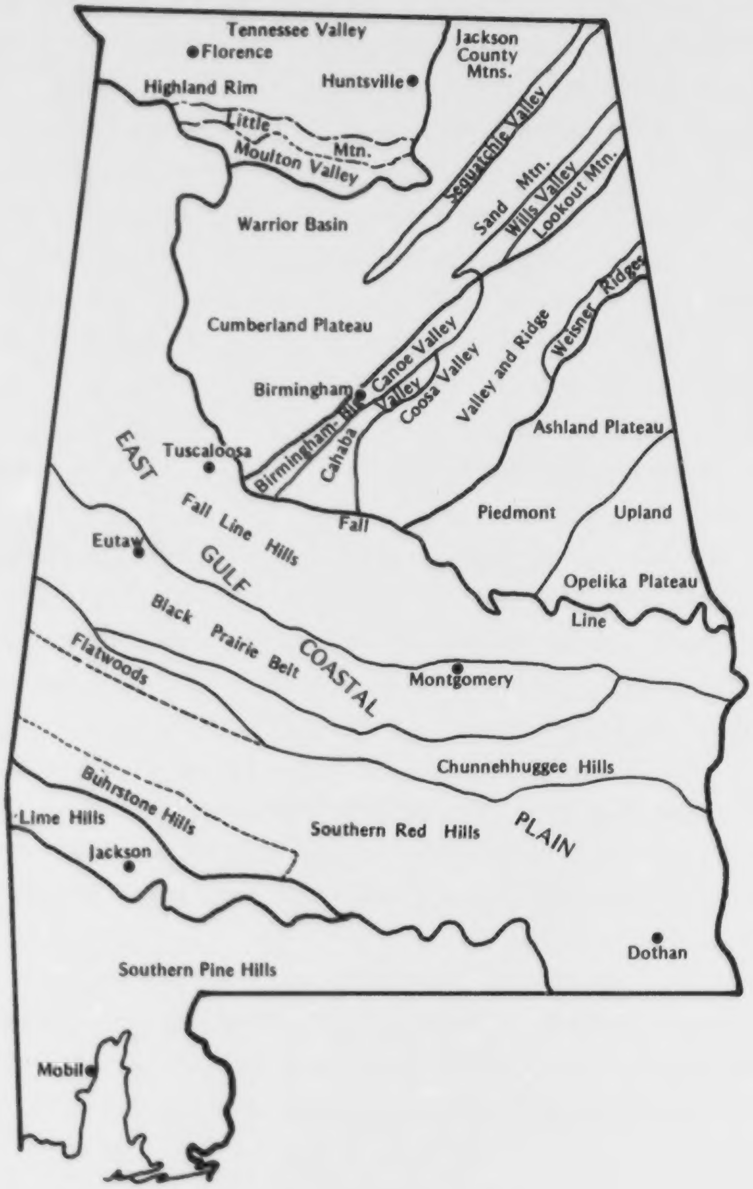

Tennessee Valley
Florence
Jackson County Mtns.
Highland Rim
Huntsville
Little Mtn.
Moulton Valley
Sequatchie Valley
Sand Mtn.
Wills Valley
Lookout Mtn.
Warrior Basin
Cumberland Plateau
Weisner Ridges
Canoe Valley
Birmingham
Birmingham-Rid
Cahaba Valley
Coosa Valley
Valley and Ridge
Ashland Plateau
Tuscaloosa
EAST GULF COASTAL PLAIN
Fall Line Hills
Fall Line
Piedmont Upland
Opelika Plateau
Eutaw
Black Prairie Belt
Flatwoods
Montgomery
Chunnehhuggee Hills
Buhrstone Hills
Lime Hills
Southern Red Hills
Jackson
Dothan
Southern Pine Hills
Mobil

FIG. 3-12. PHYSIOGRAPHIC PROVINCES OF ALABAMA

The rocks of the Valley and Ridge are folded, faulted, otherwise deformed by mountain-building processes in the geologic past. It is this history of deformation that caused the belted pattern of rock formations shown in Figure 3-13 and is responsible for belts of the same formation appearing repetitively across the grain (northwest to southeast).

The last major episode of orogenic activity affecting the south end of the Valley and Ridge province of the Southern Appalachians occurred toward the end of the Paleozoic Era, when sediments collecting along the eastern edge of North America for many millions of years were buckled and fractured into a long, high range of mountains. This mountain building episode has been called the Allegheny orogency. It resulted in the basic structure of the Valley and Ridge province that extends from Alabama northeast to Canada. In Jefferson County, as elsewhere throughout the Valley and Ridge province in Alabama, the structural trend is southwest. A series of anticlines and synclines, paralleled by thrust faults and cut by cross faults, extends across the county.

The stream courses of the Valley and Ridge are closely related to the structure and composition of the rocks. Erosion subsequent to mountain building etched resistant rocks into ridges whereas areas of "weaker" (softer) rocks became valleys. Most of the smaller streams are in the northeast-southwest trending valleys. However, the larger streams turn to the northwest, flowing at essentially right angles to this structural "grain," possibly having originally been guided by rock fractures perpendicular to the grain.

The Valley and Ridge province is underlain by sedimentary rock strata now tilted and folded. Valleys are generally floored by shales and limy shales, or by limestones. The dolomites and sandstones form ridges. The floors of the anticlinal valleys, Opossum and Jones, rise above the elevations of the Warrior Basin causing drainage from the two Valleys to the Warrior Basin to the northwest.

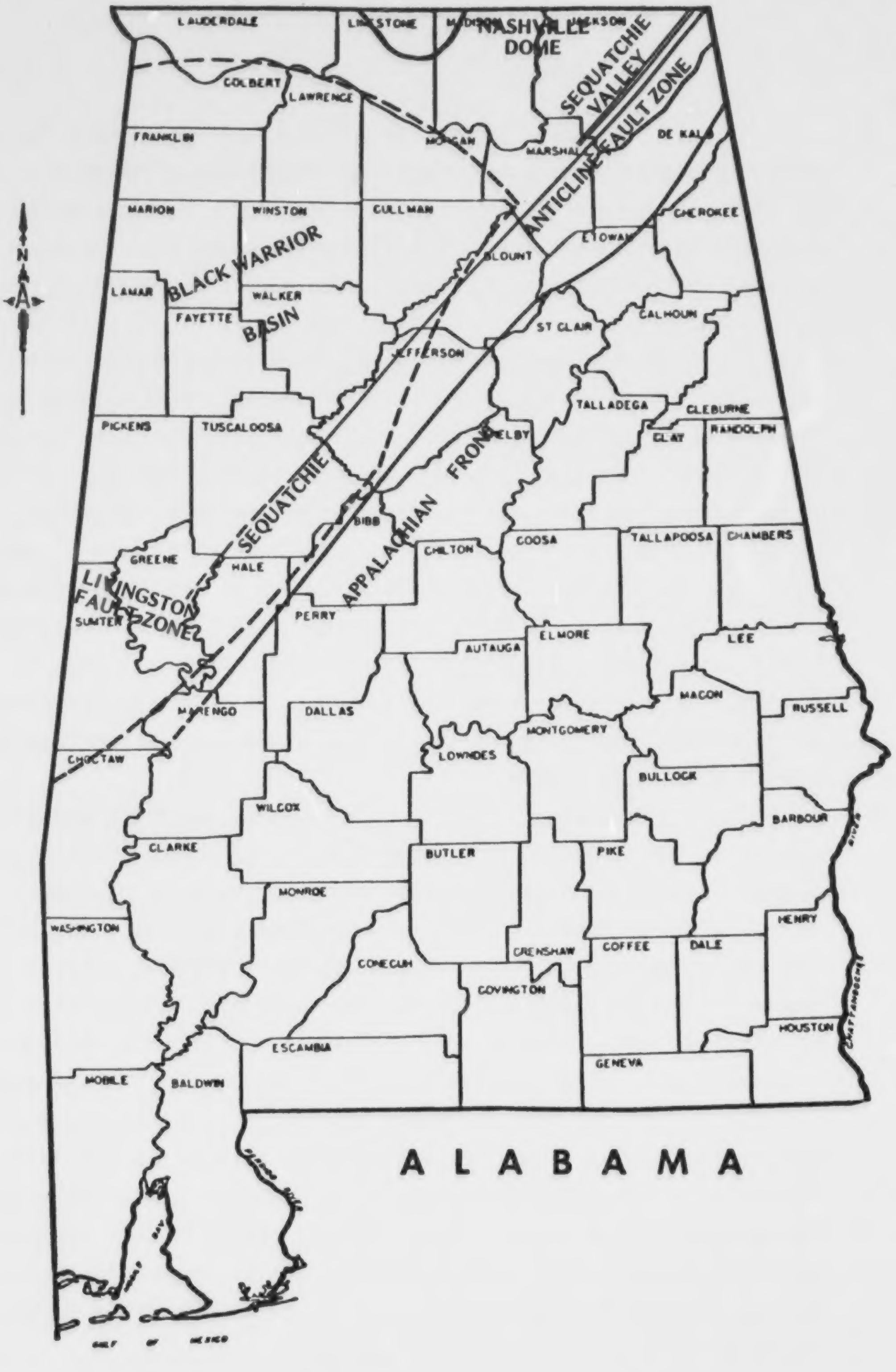

NASHVILLE DOME
SEQUATCHIE VALLEY
ANTICLINE FAULT ZONE
BLACK WARRIOR BASIN
SEQUATCHIE
APPALACHIAN FRONT
LIVINGSTON FAULT ZONE
N
A
LAUDERDALE
LIMESTONE
MADISON
JACKSON
COLBERT
LAWRENCE
FRANKLIN
MORGAN
MARSHALL
DE KALB
MARION
WINSTON
CULLMAN
CHEROKEE
ETOWAH
BLOUNT
LAMAR
WALKER
FAYETTE
CALHOUN
ST CLAIR
JEFFERSON
TALLADEGA
CLEBURNE
PICKENS
TUSCALOOSA
SHELBY
CLAY
RANDOLPH
BIBB
GREENE
HALE
CHILTON
COOSA
TALLAPOOSA
CHAMBERS
SUMTER
PERRY
ELMORE
AUTAUGA
LEE
MARENGO
DALLAS
MACON
RUSSELL
MONTGOMERY
LOWNDES
CHOCTAW
BULLOCK
WILCOX
BARBOUR
CLARKE
BUTLER
PIKE
MONROE
WASHINGTON
HENRY
CRENSHAW
COFFEE
DALE
CONECUH
COVINGTON
HOUSTON
ESCAMBIA
GENEVA
MOBILE
BALDWIN
GULF OF MEXICO
ALABAMA

FIG. 3-13. MAJOR STRUCTURAL FEATURES IN NORTHWESTERN ALABAMA

The Opossum-Murphrees anticline brings up rocks of Cambrian and Ordovician ages. These outcrop in the northern part of Birmingham and extend to the northeast along Murphrees Valley. The Birmingham anticline, occupied by Jones Valley, extends to the northeast where it joins the anticline occupied by the Coosa River in Etowah and Cherokee Counties. Separating the anticlinal valleys is the Blount Mountain syncline, which is low in the vicinity of the U. S. Steel Fairfield Works site and the City of Fairfield, but forms Blount Mountain in the northern part of the county.

3.1.6.2. Structural Considerations of Regional Geology

Jefferson County is geologically underlaid by deposits of sandstones, shales, chert, dolomites, and limestones (Figure 3-14). The Hartselle sandstone is a stable rock with a high weight-bearing capacity, often occurring in steep terrain. Its weight-supporting capacity is generally superior, but excavation can be a problem. The Red Mountain formation, consisting of sandstones, shales and hematite beds, contains many load bearing and excavation similarities to the Hartselle sandstone. QTG consists of terrace gravels and sand, generally offering a relatively stable foundation for construction as contrasted to QAL which consists of alluvial flood plain deposits of questionable value because of their location. These geological formations, except for QAL, run along the crest of the Red Mountain ridge throughout its extent and spread out in patchy deposits in the northeastern portion of the county.

Construction in Jefferson County in areas underlaid by limestones should be preceded by an engineered site analysis of the foundation conditions.

Local geologic conditions at the plant site have been further delineated by test borings at the location of the proposed Blast Furnace No. 8. Twelve test borings were drilled at the locations shown in Figure 3-15. Each boring was advanced through the soil overburden to the top of rock by a wash-boring method without sampling

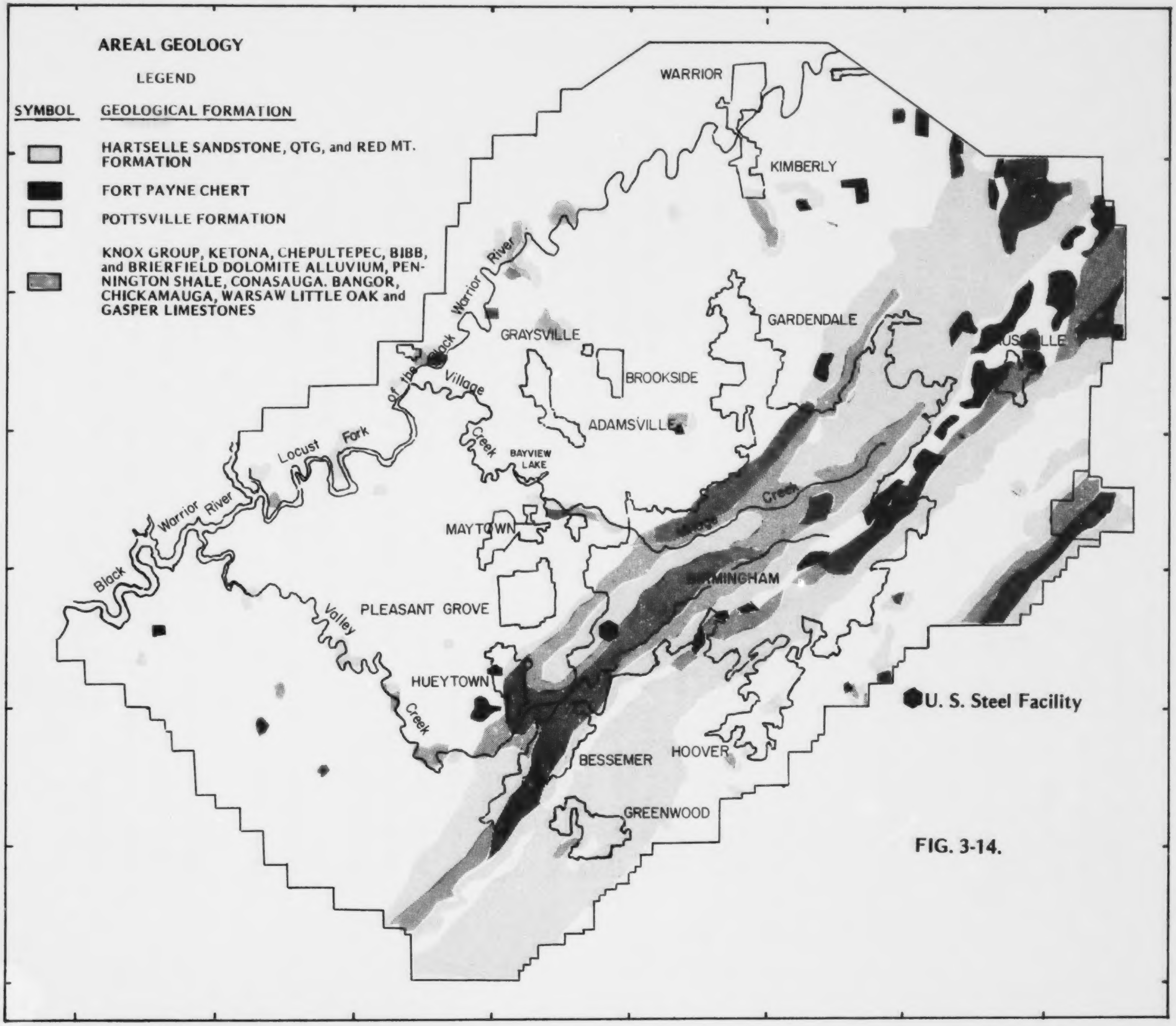

AREAL GEOLOGY
LEGEND
SYMBOL
GEOLOGICAL FORMATION
HARTSELLE SANDSTONE, QTG, and RED MT. FORMATION
FORT PAYNE CHERT
POTTSVILLE FORMATION
KNOX GROUP, KETONA, CHEPULTEPEC, BIBB, and BRIERFIELD DOLOMITE ALLUVIUM, PENNINGTON SHALE, CONASAUGA. BANGOR, CHICKAMAUGA, WARSAW LITTLE OAK and GASPER LIMESTONES
WARRIOR
KIMBERLY
GARDENDALE
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
MAYTOWN
PLEASANT GROVE
HUEYTOWN
BIRMINGHAM
BESSEMER
HOOVER
GREENWOOD
Warrior River
Locust Fork of the Black Warrior River
Black Warrior River
Village Creek
Valley Creek
Creek
U. S. Steel Facility

FIG. 3-14.

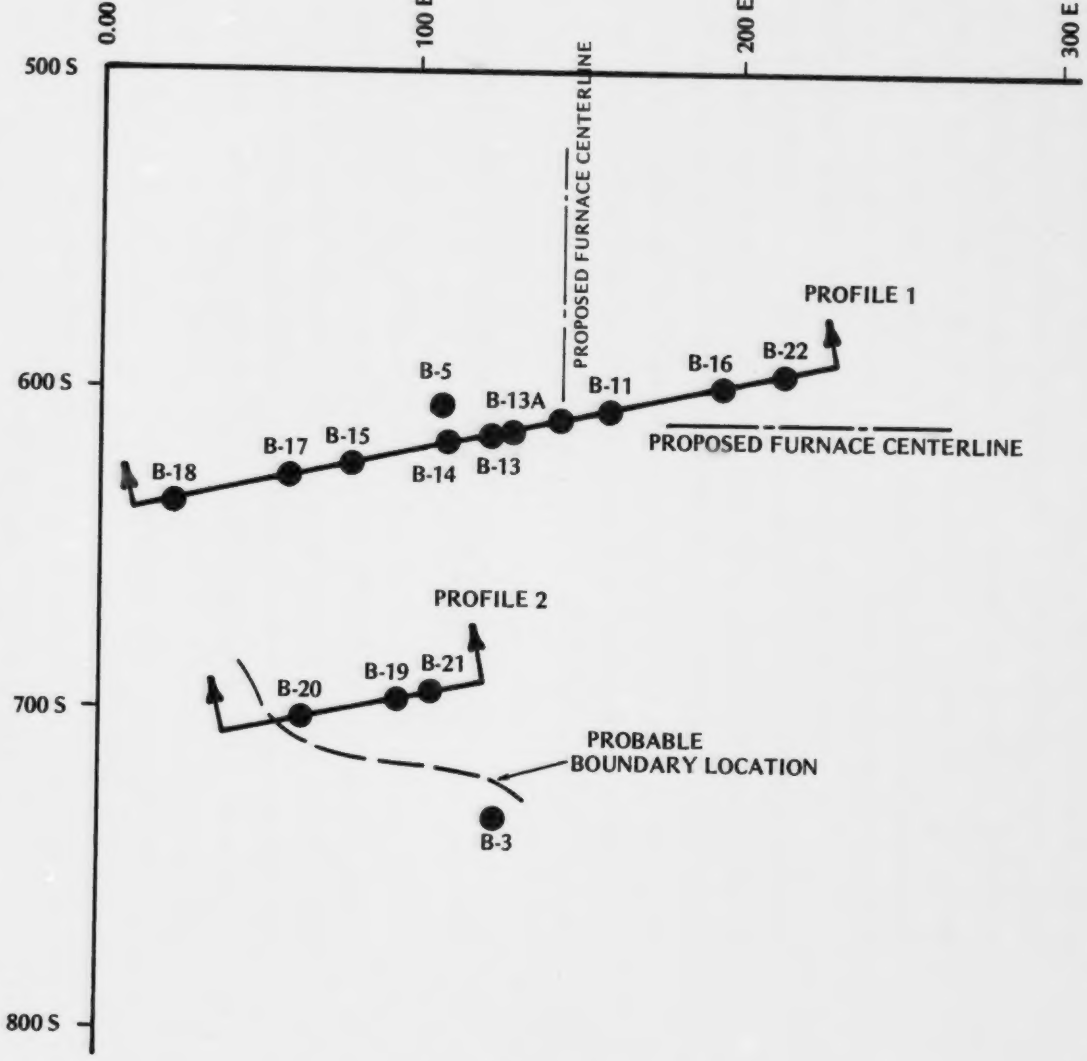

0.00 E
100 E
200 E
300 E
500 S
600 S
700 S
800 S
PROPOSED FURNACE CENTERLINE
PROFILE 1
B-5
B-13A
B-11
B-16
B-22
B-18
B-17
B-15
B-14
B-13
PROPOSED FURNACE CENTERLINE
PROFILE 2
B-20
B-19
B-21
PROBABLE
BOUNDARY LOCATION
B-3

FIG. 3-15. BORING PLAN

of the soils penetrated. When refusal (indicated top of rock) was attained, wireline drilling tools were introduced into the bore hole.

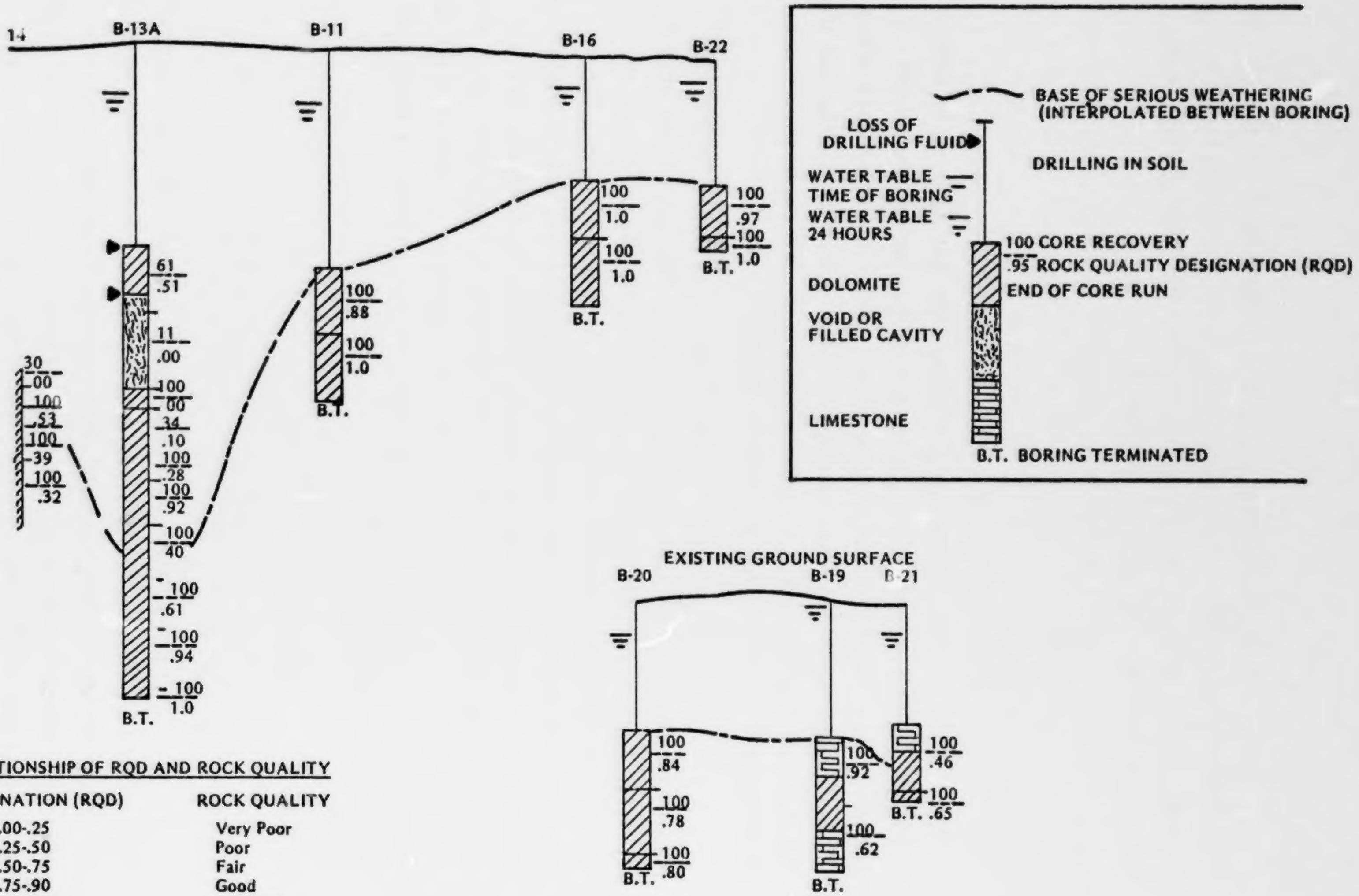
The findings of the test borings indicate the location of the geologic boundary between the Ketona Dolomite and the Consauga Formation. Boring B-18 is located roughly 120 feet west of the proposed furnace center and encountered Ketona Dolomite throughout its depth. Borings B-19 and B-21 encountered interbedded limestones and dolomites which are believed to be a transitional phase between the two units. The rock is similar to that found in B-2 of the Preliminary Investigation and probably belongs to the Ketona Dolomite. The probable boundary location is shown on the Boring Plan.

The boring data also indicate that the proposed furnace location overlies a zone of deep weathering and cavitation as indicated on the Generalized Boring Profiles shown in Figure 3-16. The "Base of Serious Weathering" is derived from visual inspection of the rock. While these data are interpolations between borings and smaller, deeply-weathered zones may be present east of Boring B-11, the trends present in Borings B-13A, B-14, and B-15 are obvious.

3.1.6.3. Geologic Structures Influencing Ground Water and Ground Water Resources

The rocks that crop out in Jefferson County near the project site can be divided into seven groups, based on the character and occurrence of the ground water which they contain. In these groups are found rocks of similar lithologic character and physiographic expression. The formations from the most ancient to the geologically youngest are:

1. The Rome formation.
2. Conasauga limestone.
3. Cambrian or Ordovician dolomites.
4. Ordovician limestones.
5. Red Mountain formation.
6. Mississippi chert and limestones.
7. Pottsville formation.


14
B-13A
B-11
B-16
B-22
61
.51
11
.00
100
.00
.34
.10
100
.28
100
.92
100
40
100
.61
100
.94
100
1.0
B.T.
30
.00
100
.53
100
.39
100
.32
100
.88
100
1.0
B.T.
100
1.0
100
1.0
B.T.
100
.97
100
1.0
B.T.
BASE OF SERIOUS WEATHERING (INTERPOLATED BETWEEN BORING)
LOSS OF DRILLING FLUID
DRILLING IN SOIL
WATER TABLE TIME OF BORING
WATER TABLE 24 HOURS
100 CORE RECOVERY
.95 ROCK QUALITY DESIGNATION (RQD)
END OF CORE RUN
DOLOMITE
VOID OR FILLED CAVITY
LIMESTONE
B.T. BORING TERMINATED
EXISTING GROUND SURFACE
B-20
B-19
B-21
100
.84
100
.78
100
.80
B.T.
100
.92
100
.62
B.T.
100
.46
100
.65
B.T.

RELATIONSHIP OF RQD AND ROCK QUALITY

DESIGNATION (RQD)	ROCK QUALITY
.00-.25	Very Poor
.25-.50	Poor
.50-.75	Fair
.75-.90	Good
.90-1.00	Excellent

FIG. 3-16. BORING PROFILE

These formations are shown as they occur in the following generalized geological cross section of the Fairfield Works area (Figure 3-17). A detailed discussion of each of these groups is presented in the Technical Support Document.

3.1.7. Soils

3.1.7.1. Soil Types Occurring

Jefferson County is divided into two major soil areas with subdivisions based on the geological character of the parent materials from which the soils were formed. The two major soil areas of Jefferson County are the Limestone Valleys and Uplands area and the Appalachian Plateau area. A detailed discussion of these soil types is presented in the Technical Support Document.

Soils of Site. Soils of the U. S. Steel Corporation plant site are in a disturbed condition due to the activities associated with past construction and industrial activities. Excavations as well as fills and grading operations have greatly altered the surface distribution of natural soils occurring over the entire plant site. Based on test boring records of the Law Engineering Company, fills have been identified at the site of No. 8 Blast Furnace that range from 0.7 feet deep to 12.5 feet deep. The fill overlies a thicker layer of firm to very stiff red, silty clay which in turn overlies a hard, red and tan silty clay.

3.1.8. Hydrology

3.1.8.1. General

In the Birmingham area, water is available from surface streams and groundwater aquifers. Due to the wide variability of flow exhibited by the natural surface water streams, flow-regulated reservoirs are necessary to guarantee water availability. The median flows of unregulated streams in Alabama range from 7 to 75 percent of their

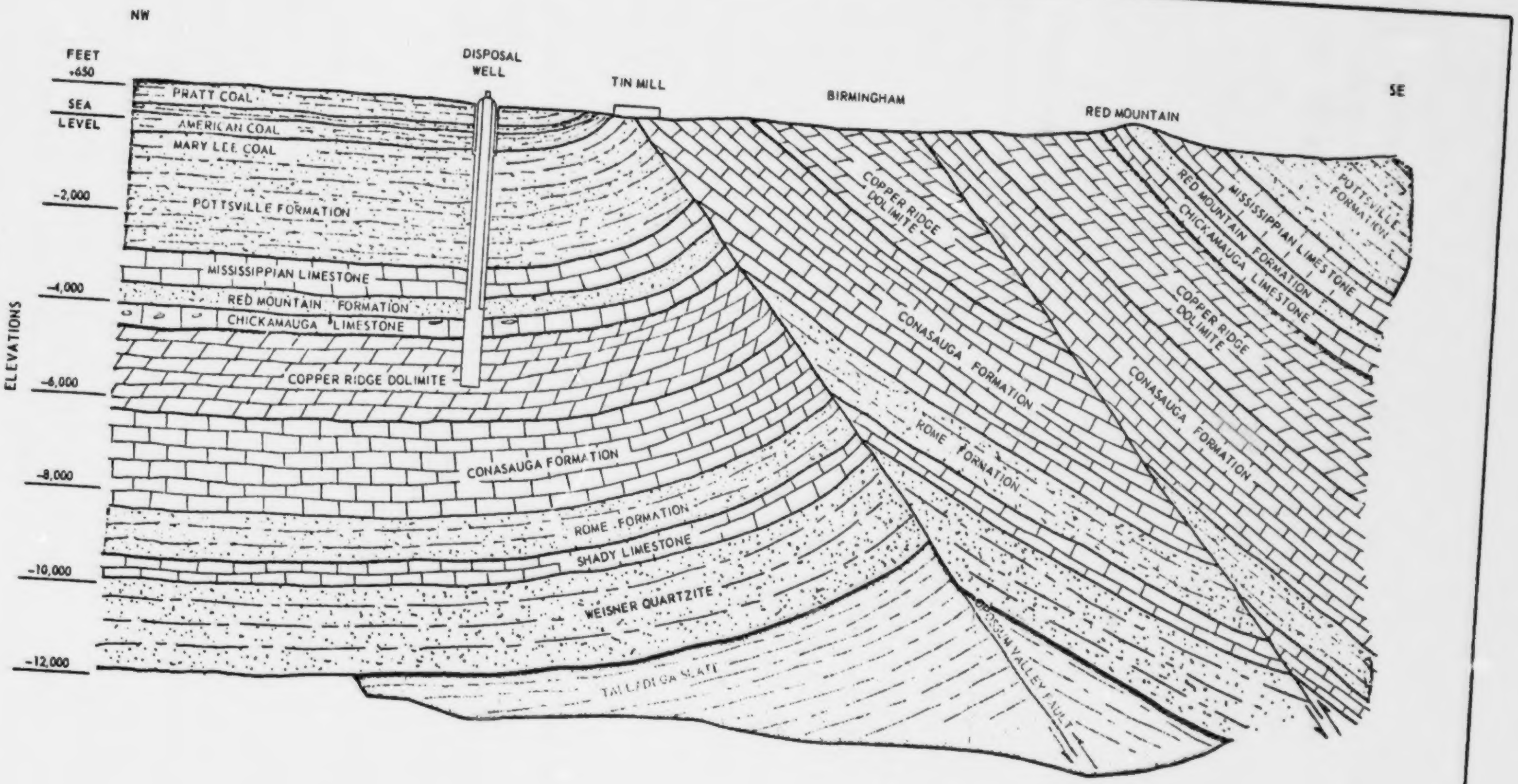

NW
SE
FEET
+650
SEA LEVEL
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
ELEVATIONS
DISPOSAL WELL
TIN MILL
BIRMINGHAM
RED MOUNTAIN
PRATT COAL
AMERICAN COAL
MARY LEE COAL
POTTSVILLE FORMATION
MISSISSIPPIAN LIMESTONE
RED MOUNTAIN FORMATION
CHICKAMAUGA LIMESTONE
COPPER RIDGE DOLIMITE
CONASAUGA FORMATION
ROME FORMATION
SHADY LIMESTONE
WEISNER QUARTZITE
TALLADEGA SLATE
OPOSSUM VALLEY FAULT
COPPER RIDGE DOLIMITE
CONASAUGA FORMATION
ROME FORMATION
COPPER RIDGE DOLIMITE
CONASAUGA FORMATION
CHICKAMAUGA LIMESTONE
RED MOUNTAIN FORMATION
MISSISSIPPIAN LIMESTONE
POTTSVILLE FORMATION

FIG. 3-17. GENERALIZED GEOLOGICAL CROSS SECTION OF FAIRFIELD AREA
SOURCE: GEOLOGICAL SURVEY OF ALABAMA

average flows. In general, for the State of Alabama, the median streamflow is approximately 60 percent of the average streamflow.

Groundwater serves as the dry weather source to area streams as well as a source of water supply for many users. In Jefferson County, groundwater is found in both water table and artesian conditions.

3.1.8.2. Black Warrior River Basin

Fairfield Works, the site of the proposed new source, is located within the Black Warrior River Basin. This is the second largest river basin in the State of Alabama with a drainage area of approximately 6,300 square miles. Figure 3-9 depicts the Black Warrior River System above Bankhead Lock and Dam.

Approximately one (1) million people are found within the area drained by the Black Warrior River System. Rivers within this system display a flashy response to high rates of rainfall. However, geological formations do not permit sufficient sustenance of dry weather flow by groundwater reservoirs. Consequently, low flow is a limiting factor from the standpoint of water quality attainment within the Basin.

For the Basin, the average annual precipitation is 52 inches and is approximately evenly distributed throughout the year. The average annual runoff is approximately 20 inches.

3.1.8.3. Stream Flows

Normal Flows. The major tributaries to the Black Warrior River are Sipsey Fork, Mulberry Fork, and the Locust Fork. Table 3-10 presents a summary of published streamflow data (United States Geologic Survey and Alabama Geologic Survey) for Jefferson County. Very little extended monthly or daily flow information exists for streams in the western portion of the county, with the exception of Turkey Creek. Turkey Creek has been monitored continuously since 1944 and mean monthly hydrographs are exhibited in Figure 3-18 for a period from 1951 through 1970. Given this extended period of record,

TABLE 3-10

STREAMFLOW DATA AVAILABLE FOR STREAMS IN JEFFERSON COUNTY

Station Number	Station Name	Daily or Monthly Figures (calendar years)	Annual Peaks (water years)	Low Flow Measurements (water years)	Remarks
Streamflow					
02423570	Shades Creek at Irondale		1968-71	1948, 1964	
02423573	Shades Creek near Mountain Brook		1968-	1971, 1972	ADR tape
02423580	Shades Creek at Homewood		1968-	1971, 1972	ADR tape
02423620	Little Shades Creek at Alabama Hwy 150 near Bessemer				Indirect measurement for flood of 3/19/70
02423623	Unnamed tributary to Little Shades Creek near Bessemer			1967	
02423625	Shades Creek at Hopewell		1968-72	1953, 1956, 1964, 1967	
02423630	Shades Creek at Greenwood	1964-65[1]; 1966-	1966[1]		Strip chart and/or ADR tape (1964-)
02423639	Mud Creek near Greely				
02455800	Gurley Creek near Trafford				
02455990	Turkey Creek near Crosston				Contracted opening measurement on 3/20/70
02456000	Turkey Creek at Morris	1944-[1]			Strip chart and/or ADR tape (1944-)
02457000	Five Mile Creek at Ketona	1953-58[1]	1959-[1]	1964[1], 1967	
02457500	Five Mile Creek at Tarrant City	1936[1]		1964[1]	
02457650	Five Mile Creek at Cardiff			1964[1]	
02457700	Five Mile Creek at Lynn Crossing		1965[1]		Indirect measurement for flood of 3/19/70
02458150	Village Creek at East Lake in Birmingham				Indirect measurement for flood of 3/19/70
02458200	Village Creek at Apalachee Street in Birmingham		1971-		Indirect measurement for flood of 3/19/70
02458500	Village Creek at Ensley	1936[1]		1945, 1946, 1952[1]	
02459000	Camp Branch near Ensley	1909-10[1]			
02459300	Bayview Reservoir				
02459500	Venison Branch near Mulga				
02460000	Village Creek near Mulga	1909; 1910[1, 2]			
02460500	Village Creek near Adamsville	1953-58; 1964-65[1], 1973-	1959-64; 1966-72[1]		Strip chart (1964-65)
02460505	Village Creek at Porter			1964	Water quality monitoring (1971-)
02461400	Valley Creek at Brighton			Low flow measurements upstream and downstream	Indirect measurement for flood of 3/19-20/7
02461500	Valley Creek near Bessemer	1936[1]		1946[1]	Miscellaneous measurements
02462000	Valley Creek near Oak Grove	1936; 1953-58: 1964-65[1]	1959-63; 1966[1]		Strip chart (1953-58; 1964-65)
02462025	Lost Creek near Pleasant Grove				
02462040	Rock Creek near Hopkins			1967, 1968	Miscellaneous measurements
02462080	Mud Creek near Oak Grove			1967, 1968	Miscellaneous measurements
					Recording rain-gage data (1937-)
					Recording rain-gage data (1942-67)

---

[1] Gage heights, or gage heights and discharge measurements only.

[2] Data are available in published reports.

Note: A date followed by only a dash shows that data collection is continuing.

Source: Alabama Geological Survey and USGS Records.

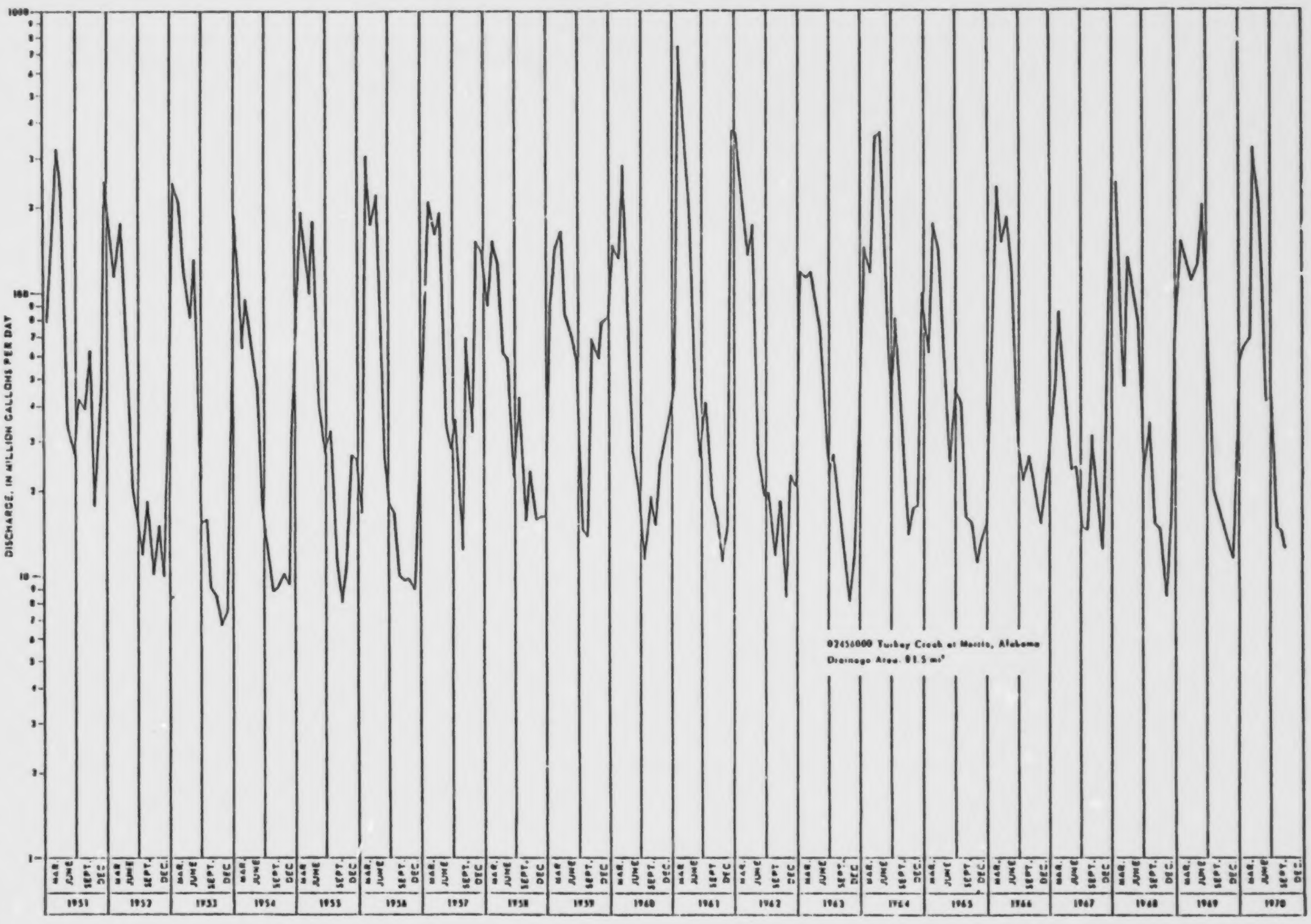


FIG. 3-18.MONTHLY MEAN HYDROGRAPHS FOR GAGING STATION ON TURKEY CREEK

the Alabama Geologic Survey has constructed a flow-duration curve for Turkey Creek (Figure 3-19). If it is assumed that this relationship is applicable to the major tributaries of the Black Warrior River, the following flow frequencies could be expected.

Stream	Drainage Area (sq mi)	Flow Expectancy (mgd) <1%	<25%	<5%
Sipsey Fork	1,000	10,000	1,000	100
Mulberry Fork	2,366	23,660	2,366	237
Locust Fork	1,227	12,227	1,227	123
Black Warrior River	6,300	63,000	6,300	630

Drought Flows. The Alabama Geologic Survey has tabulated extreme low flow data, for several streams in the Black Warrior River Basin, in sufficient detail to permit prediction of the magnitude of extreme low flow to be expected at recurrent intervals. Based on this collection of data, the most extreme drought per year of 14-days duration was selected to represent adverse conditions from water quality conditions. A graphical technique (Gumbel) was used to calculate recurrence intervals for critical drought flows. A summary of this investigation is presented in Tables 3-11 and 3-12. The reader is referred to the Technical Support Document for details.

Flooding. The highest stages on record for several streams in Jefferson County were observed following the storm of March 19, 1970. The National Weather Service at Birmingham Municipal Airport recorded 6.91 inches of rainfall with 4.73 inches falling within a six-hour period beginning at 6 AM. The durations, intensities, and recurrence intervals for this storm were computed from the records of the Birmingham Municipal Airport and are presented in Table 3-13.

Figure 3-20 provides a map of the flood prone areas near Fairfield Operations for the 100-year storm. Inspection of this map reveals that the area of flooding does not include Fairfield Operations to any appreciable extent.

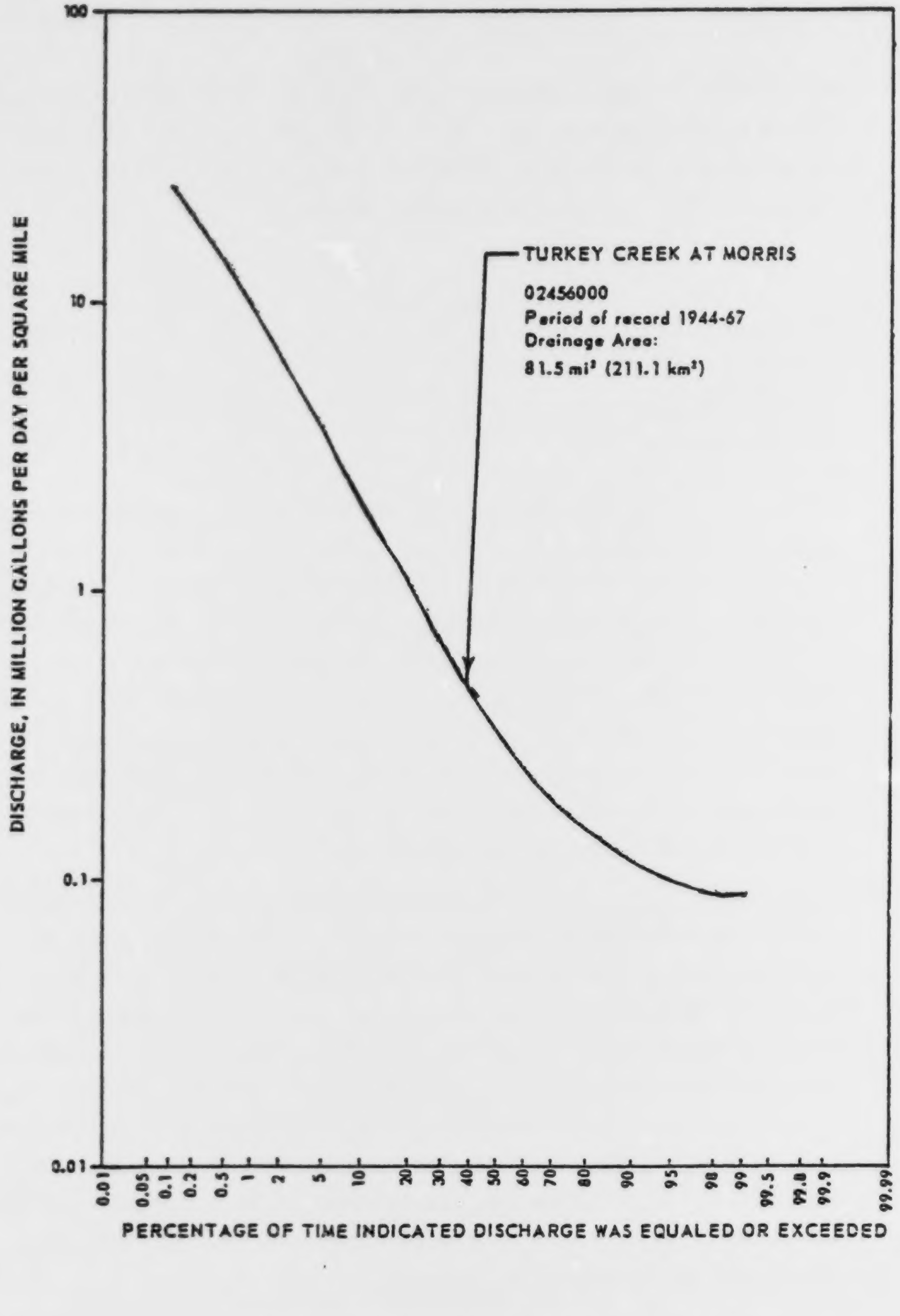


FIG. 3-19.FLOW-DURATION FOR TURKEY CREEK

TABLE 3-11

AVERAGE 14 DAY LOW FLOWS

Location	Discharge (cfs)	Period Averaged
Sipsey Fork at Sipsey (Pre-Dam)	52.6	1929 - 1936
Mulberry Fork at Cordova	122.4	1901 - 1911
Locust Fork at Sayre	52.1	1946 - 1962
Locust Fork at Bessemer (Before Inland Dam)	181.7	1929 - 1935
Five Mile Creek at Ketona	7.1	1954 - 1957
Valley Creek at Oak Grove	114.0	1954 - 1957

TABLE 3-12

SUMMARY FOR VARIOUS TIMES OF RECURSION FOR EACH STREAM 14-DAY LOW FLOW CONDITION

	3 yr	4 yr	5 yr	6 yr	10 yr	20 yr	40 yr	50 yr
A	41.0	32.0	27.0	23.0	10.5	0	0	0
B	29.0	25.0	22.0	20.0	12.0	4.0	0	0
C	70.0	57.0	49.0	43.0	22.5	4.0	0	0
D	36.0	30.0	29.0	28.5	28.0	27.5	23.5	23.0
E	6.0	5.4	4.9	4.6	3.7	2.4	1.2	0.8
F	65.0	0	0	0	0	0	0	0
G	108.0	103.0	100.0	98.0	92.0	79.0	75.0	71.0

A - Sipsey Fork, Sipsey

B - Mulberry Fork, above

C - Mulberry Fork, below

D - Locust Fork, Sayre

E - Five Mile Creek

F - Locust Fork, Bessemer

G - Valley Creek

TABLE 3-13

STORM OF MARCH 19, 1970

Elapsed Time (hr)	Accumulation (in.)	Intensity (in./hr)	Recurrence Interval (yr)
0.5	0.90	1.80	1
1.0	1.32	1.32	1
2.0	2.42	1.21	2
3.0	3.12	1.04	5
6.0	4.56	0.76	20
12.0	6.57	0.55	40
24.0	7.07	0.29	30

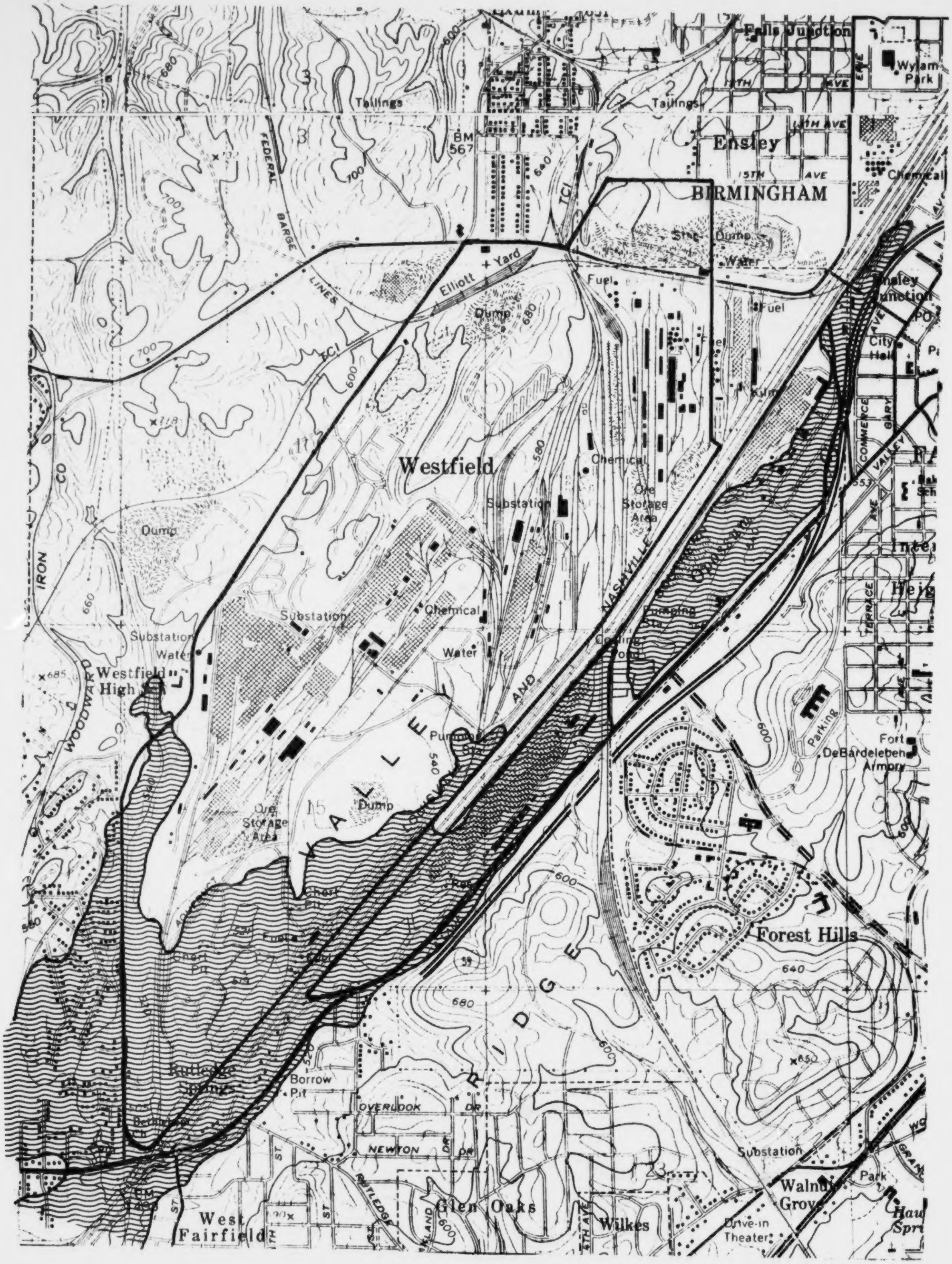

Falls Junction
Wylam Park
Tailings
Tailings
Ensley
BIRMINGHAM
15TH AVE
Chemical
BM 567
FEDERAL BARGE LINES
TCI
Elliott Yard
Dump
Fuel
Fuel
Fuel
Slag Dump
Water
Ensley Junction
City Hall
Kiln
Westfield
Chemical
Substation
Ore Storage Area
NASHVILLE
AND
Dump
IRON CO
WOODWARD
Substation
Substation
Water
Chemical
Water
Westfield High Sch
Pumping
Pumping
VALLEY
Dump
Ore Storage Area
COMMERCE
GARY
VALLEY
TERRACE
Inter Heig
Parking
Fort DeBardeleben Armory
Forest Hills
RIDGE
Chert Pit
Chert Pit
Rutledge Springs
Borrow Pit
OVERLOOK DR
NEWTON DR
RUTLEDGE
Bethlehem
BM
West Fairfield
Glen Oaks
Wilkes
Substation
Walnut Grove
Drive-in Theater
Park
700
700
680
660
640
600
580
540
680
640
600
685
650

FIG. 3-20. MAP OF FLOOD PRONE AREA FOR THE 100-YEAR FLOOD NEAR FAIRFIELD OPERATIONS

3.1.8.4. Groundwater Aquifers

Figure 3-21 depicts the availability of groundwater in Jefferson County. Several formations are present which are important from water supply considerations.

The Conasauga Formation supplies a number of wells in Birmingham with yields ranging from 50 to 100 gallons per minute (gpm). The Conasauga formation is a limestone formation and, as such, is comprised of large reservoirs (solution channels) and also areas in which these solution channels are widely spaced. These latter areas provide relatively low yields to dug wells. The Conasauga formation feeds some large springs, e.g. Picket and Spencer Springs on the outskirts of Bessemer.

Other groundwater formations in the Jefferson County area include the Ketona, Copper Ridge, Chepultepec, Chicamauga, Fort Payne, Bangor, and Pottsville formations.

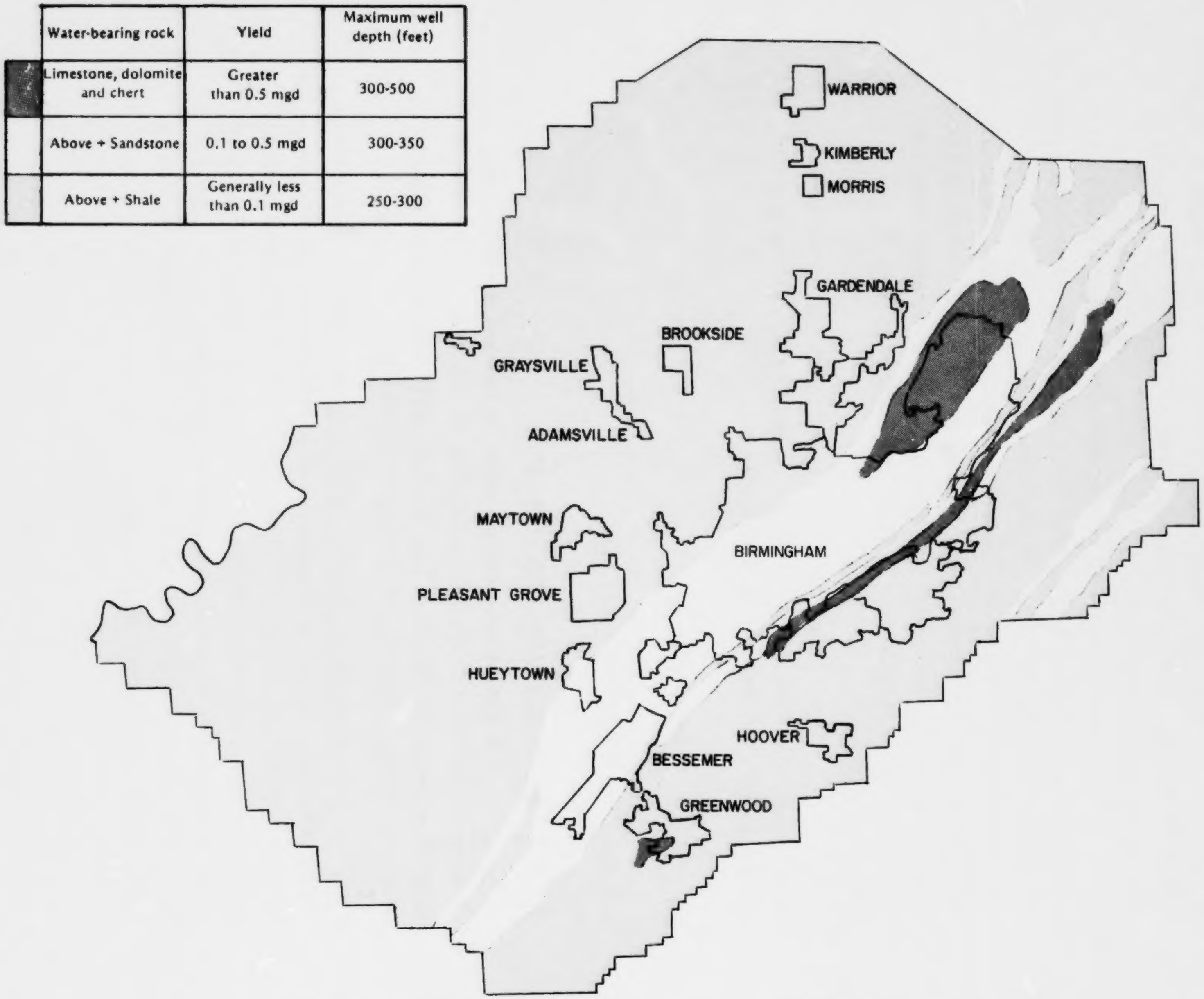
3.1.9. Water Quality

3.1.9.1. Existing Water Uses

3.1.9.1.1. Consumptive Uses of Water

A consumptive use of water is one which alters one or more of the physio-chemical properties of the water. Consumptive uses of water in Jefferson County include water supply, agriculture, forestry, waste disposal, and mining.

Potable and Process Water Supply. Table 3-14 presents information concerning the quantities of water utilized for various purposes in Jefferson County. Inspection of this table reveals that surface waters are a major source of public water supply while groundwater provides the principal source of rural domestic water supply. For the Birmingham area, important sources of water supply include Lewis Smith, Lake Purdy, Inland Lake, and the Cahaba River.


WARRIOR
KIMBERLY
MORRIS
GARDENDALE
BROOKSIDE
GRAYSVILLE
ADAMSVILLE
MAYTOWN
BIRMINGHAM
PLEASANT GROVE
HUEYTOWN
HOOVER
BESSEMER
GREENWOOD

	Water-bearing rock	Yield	Maximum well depth (feet)
■	Limestone, dolomite and chert	Greater than 0.5 mgd	300-500
□	Above + Sandstone	0.1 to 0.5 mgd	300-350
▒	Above + Shale	Generally less than 0.1 mgd	250-300

FIG. 3-21. GROUNDWATER AVAILABILITY – AQUIFER DEPTH AND YIELDS

TABLE 3-14

WATER USAGE (1970) - JEFFERSON COUNTY AND THE STATE OF ALABAMA

Use	Jefferson County Groundwater (MGD)	Jefferson County Surface Water (MGD)	Alabama Groundwater (MGD)	Alabama Surface Water (MGD)
Public Water Supply	4.18	131.40	103.07	362.74
Rural Uses				
Domestic	4.68	-	62.86	-
Livestock	0.18	0.13	12.81	14.50
Irrigation	0.07	0.16	5.37	12.48
Catfish Farming	0.00	0.02	6.59	5.36
Self-Supplied				
Industry	5.10	69.55	90.93	996.26
Thermo-Electric				
Power	0.00	0.00	2.70	5,021.10
Total	14.21	201.26	284.33	6,412.44

Source: Alabama Geologic Survey, 1970.

Agriculture. Agriculture is not a major activity in the Birmingham area due to lack of suitable land. Agricultural activities in the Birmingham area are limited primarily to truck farming. Consequently, consumptive use of water within the area due to agricultural activities is minimal.

Forestry. Large portions of northwestern Jefferson County and adjacent counties are forested and support a range of industrial roundwood products. The woodlands are a mixed hardwood and softwood stand that is primarily in private ownership. Harvesting is accompanied by increased sediment loads to the receiving streams.

Waste Disposal. The streams of Jefferson County receive a variety of wastewaters from both point (municipal, industrial, and commercial) and non-point (urban runoff, strip-mine runoff, etc.) sources. Storm events cause a flushing of pollutants, accumulated as a result of a myriad of activities associated with urban-industrial areas, into receiving streams. Figure 3-22 exhibits schematically many of the point source discharges to streams in the Birmingham area.

Municipal sewage treatment plants serve portions of Jefferson County (Figure 3-23). Currently only 97 of a total of 1,075 square miles of Jefferson County are serviced by public sewers. A summary of existing and projected public sewer coverage for Jefferson County is presented in Table 3-15. Figure 3-23 exhibits areas serviced by public sewers in Jefferson County.

Mining. The Warrior coal field constitute a major mineral resource of the area. Surface mining of coal modifies natural surface drainage patterns and exposes earth materials as spoil banks which contain soluble toxic materials. Mining operations create mill tailings and processed materials which impair water quality and add suspended materials to the streams.

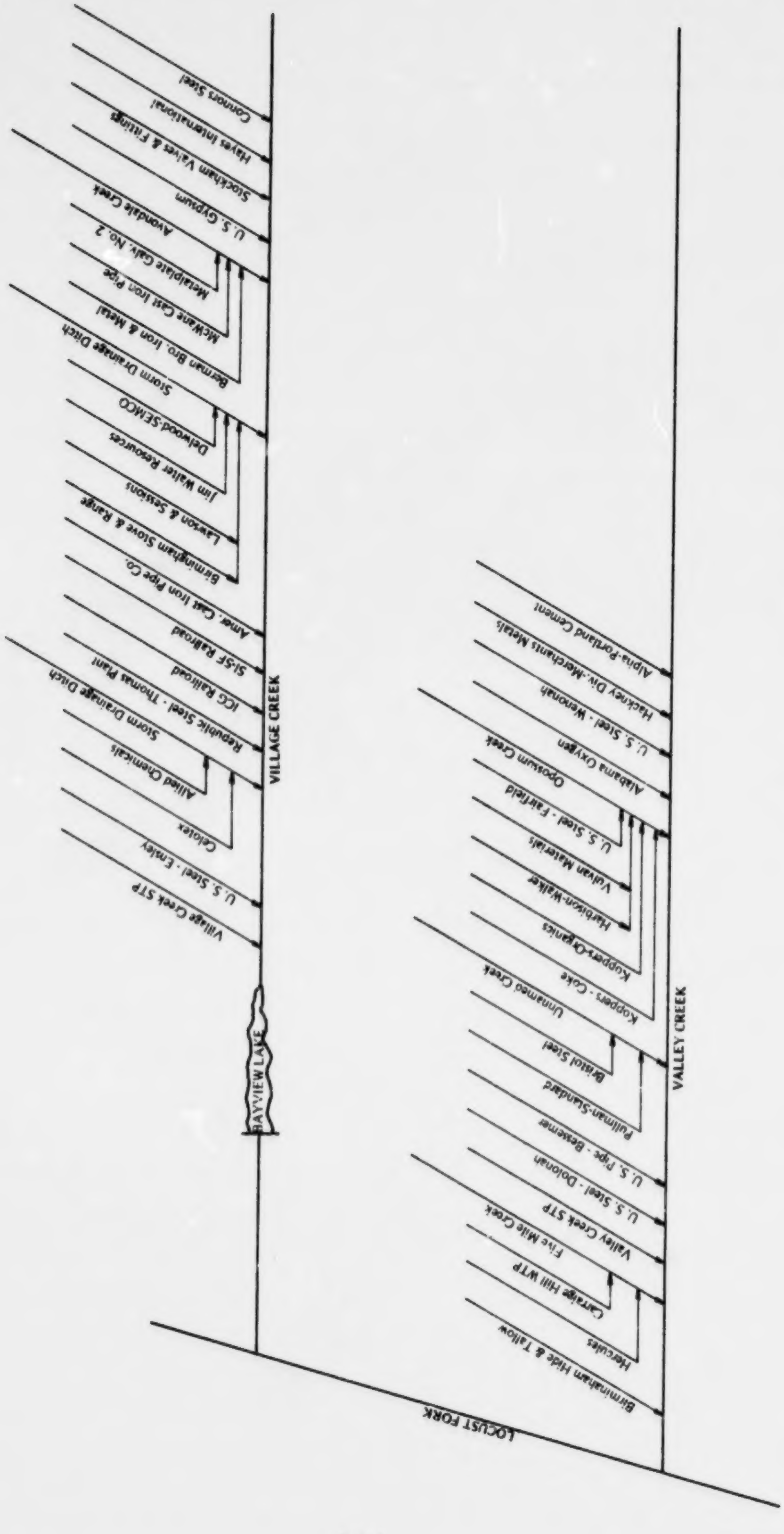
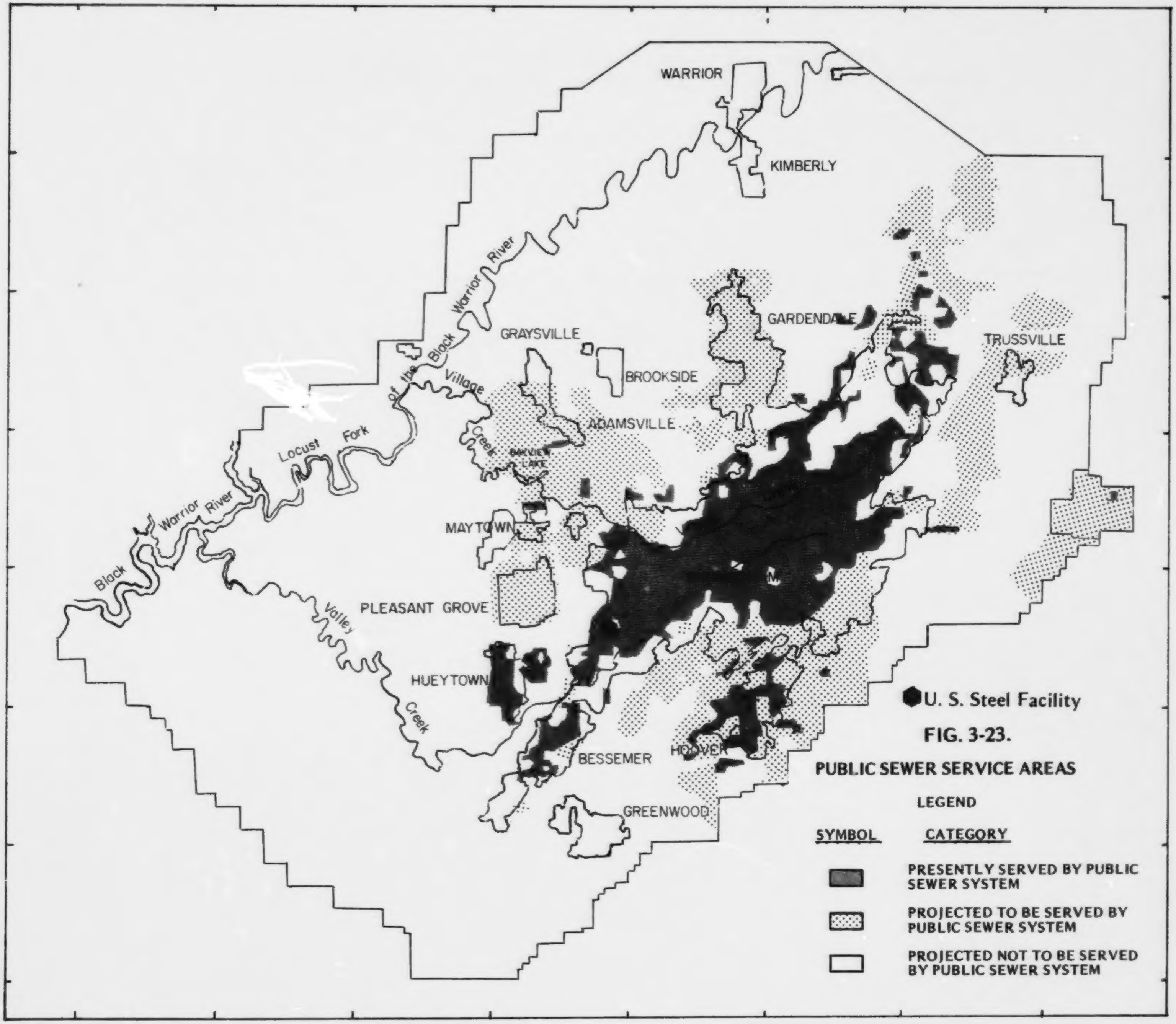

LOCUST FORK
VILLAGE CREEK
BAYVIEW LAKE
Village Creek STP
U. S. Steel - Ensley
Celotex
Allied Chemicals
Storm Drainage Ditch
Republic Steel - Thomas Plant
ICG Railroad
St-SF Railroad
Amer. Cast Iron Pipe Co.
Birmingham Stove & Range
Lawson & Sessions
Jim Walter Resources
Delwood-SEMCO
Storm Drainage Ditch
Berman Bro. Iron & Metal
McWane Cast Iron Pipe
Metalplate Galv. No. 2
Avondale Creek
U. S. Gypsum
Stockham Valves & Fittings
Hayes International
Connors Steel
VALLEY CREEK
Birminham Hide & Tallow
Hercules
Carraige Hill WTP
Five Mile Creek
Valley Creek STP
U. S. Steel - Dolonah
U. S. Pipe - Bessemer
Pullman-Standard
Bristol Steel
Unnamed Creek
Koppers - Coke
Koppers-Organics
Harbison-Walker
Vulcan Materials
U. S. Steel - Fairfield
Opossum Creek
Alabama Oxygen
U. S. Steel - Wenonah
Hackney Div.-Merchants Metals
Alpha-Portland Cement

FIG. 3-22. SCHEMATIC SHOWING RELATIVE LOCATIONS OF INDUSTRIAL AND MUNICIPAL WASTE DISCHARGE POINTS VILLAGE CREEK



WARRIOR
KIMBERLY
GARDENDALE
TRUSSVILLE
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
MAYTOWN
PLEASANT GROVE
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
Black Warrior River
Locust Fork of the Black Warrior River
Village Creek
Valley Creek

⬢ U. S. Steel Facility

FIG. 3-23.

PUBLIC SEWER SERVICE AREAS

LEGEND

SYMBOL	CATEGORY
■	PRESENTLY SERVED BY PUBLIC SEWER SYSTEM
▨	PROJECTED TO BE SERVED BY PUBLIC SEWER SYSTEM
□	PROJECTED NOT TO BE SERVED BY PUBLIC SEWER SYSTEM

TABLE 3-15

PUBLIC SEWER COVERAGE, JEFFERSON COUNTY, ALABAMA

	Acres	Square Miles	% of Total
Existing	61,918	97.0	9.0
Projected for 2000	81,869	128.0	11.9
Non-Sewered for 2000	544,189	850.0	79.1
Total	687,976	1,075.0	100.0

Source: Birmingham Regional Planning Commission.

Figure 3-24 exhibits overall land use practices in Jefferson County and delineates the extent of industrial and commercial land, residential land, agricultural land, surface extraction, and open land.

3.1.9.1.2. Non-Consumptive Water Use

Activities in the Birmingham area which utilize water in a non-consumptive manner include recreational activities, navigation, and hydroelectric power generation.

Recreation and Fishing. Commercial and sport fishing exist in Bankhead Reservoir on the Black Warrior River and certain of its tributaries. Other types of water related activities such as boating, water skiing, and camping are also pursued.

Navigation. There is both commercial and pleasure craft traffic on the Locust Fork of the Black Warrior River. Commercial vessels serve as the link connecting the industries of the Birmingham Region with the Gulf of Mexico. These vessels bring raw materials for industry up the Black Warrior and transport various finished products downstream to the Gulf. Navigation on the Black Warrior River is possible through four locks and dams built by the U. S. Army Corps of Engineers to provide a navigable channel from Mobile, Alabama to the confluence of Locust and Mulberry Forks with the Black Warrior River.

Port Birmingham, a major water transportation facility located in the Birmingham industrial area, provides a major terminal for supply of raw materials to industries within the area. Cargo is shipped by barge using the Warrior-Tombigbee River System.

The Waterway has provided a major feeder for commercial traffic with present commercial traffic exceeding ten million tons annually. The Waterway passes through 16 counties within the State of Alabama with a number of these counties including the State's most heavily developed areas. These counties consist of approximately 30 percent of the State of Alabama; 40 percent of its manufacturing establishments; 44 percent of its industrial workers; and 50 percent of its industrial payrolls.

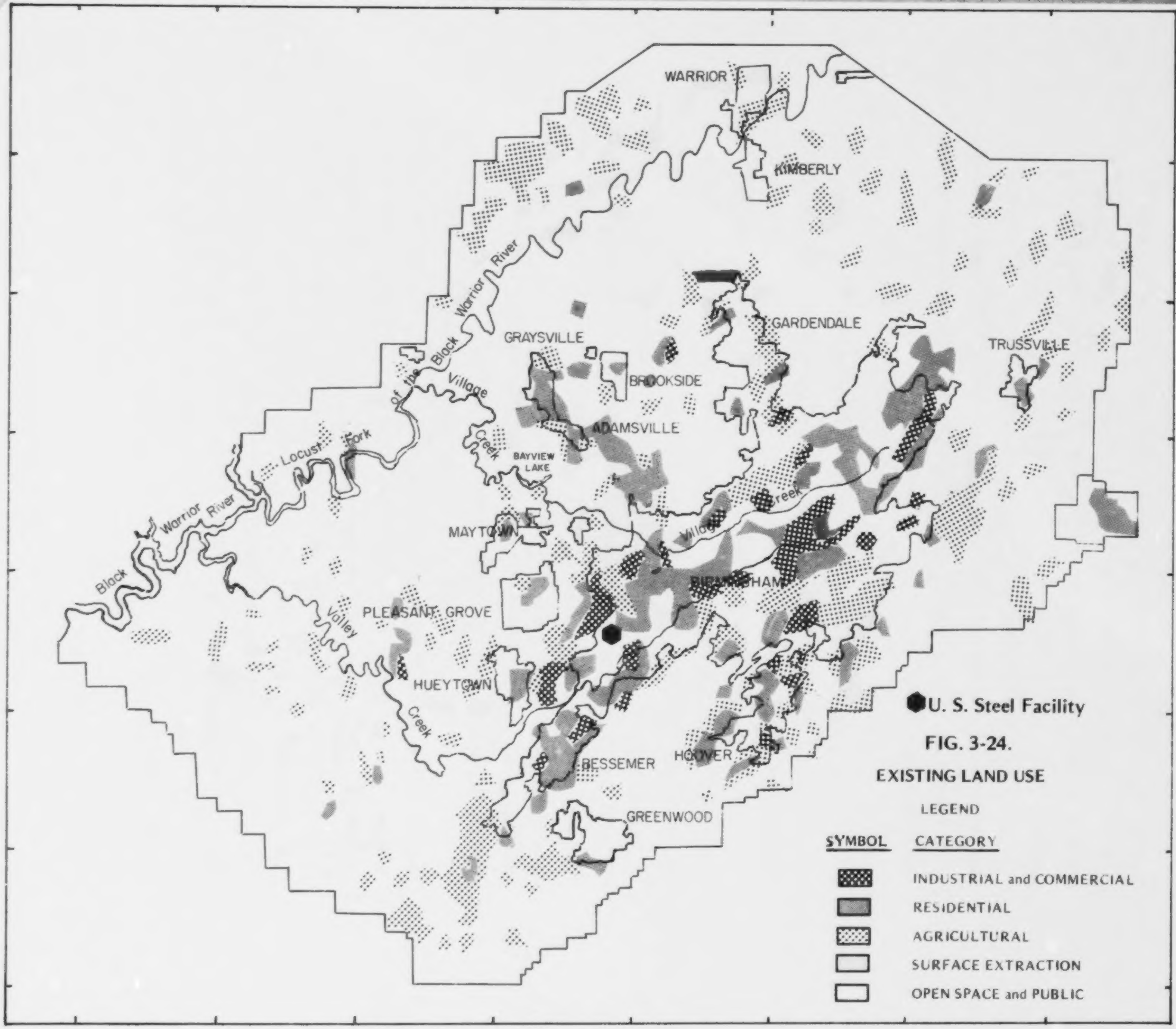

WARRIOR
KIMBERLY
GARDENDALE
TRUSSVILLE
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
MAYTOWN
BIRMINGHAM
PLEASANT GROVE
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
Black Warrior River
Locust Fork of the Black Warrior River
Village Creek
Valley Creek
U. S. Steel Facility
SYMBOL
CATEGORY
INDUSTRIAL and COMMERCIAL
RESIDENTIAL
AGRICULTURAL
SURFACE EXTRACTION
OPEN SPACE and PUBLIC

FIG. 3-24.
EXISTING LAND USE

LEGEND

Hydroelectric Operations. In 1963, the Alabama Power Company constructed a 45,000 kw turbo-generator unit in the right bank at the end of the gated spillway of Bankhead Lock and Dam. Controlled releases for power generation are used to meet power peaking demands.

On the Sipsey tributary to the Mulberry Fork of the Warrior River, the Lewis M. Smith Hydroelectric Dam at river mile 451.3 provides water power to Birmingham and flow augmentation to the downstream dams.

3.1.9.1.3. Existing Water Quality Management Plants

In accordance with PL 92-500 section 208, the 208 Study for the Birmingham area is underway at this time.

The Birmingham 208 Study encompasses four counties: Jefferson, Walker, Shelby, and St. Clair. Of these counties, Shelby and St. Clair counties are in the Cahaba River Basin. The 208 Study is an analysis of all water quality problems in the area, in which significant point sources, stormwater runoff, and other non-point sources are considered. The 208 Study will recommend water quality monitoring and surveillance locations; review and update waste load allocations, institutional and managerial arrangements; and evaluate and define recommended environmental improvement alternatives.

The 201 Study, authorized under Public Law 92-500 section 201 has been completed for Jefferson County. A new facility is being built for the Five Mile Creek STP* approximately eight river miles downstream from the existing facility. The plant is scheduled to be completed in the summer of 1977. Activated sludge and nitrification processes are utilized.

A plant expansion for the Valley Creek STP continued through the summer of 1976. The existing facility was upgraded with activated sludge and nitrification processes. Break-in of this facility is now underway.

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*Sewage Treatment Plant

Activated sludge and nitrification processes are now being installed at the Village Creek STP. Plant expansion is scheduled for completion in April 1978.

Black Creek Lagoon, Docena Treatment Facility, and Westwood WTP will all be abandoned, and wastewater flows will be diverted to Village Creek STP. Fultondale STP wastewater flow will be diverted to Five Mile Creek STP. Valley Creek STP will receive the flow from Carriage Hills STP which will be abandoned.

In June of 1976 the Alabama Water Improvement Commission completed the water quality management plan for the Black Warrior River Basin in accordance with Section 303 (e) of PL 92-500. This plan summarizes information as to existing water quality, point and non-point sources, wastewater treatment requirements and costs, and water quality surveillance network needs. Projections to future needs are also outlined.

3.1.9.2. Surface Water Quality

3.1.9.2.1. Existing Environment

As a result of the comprehensive water quality surveys performed on Opossum, Valley, Village Creeks, and Bankhead Reservoir, an accurate description of the water quality conditions occurring during the period of the survey was obtained as presented in detail in the Technical Support Document.

The results of the water quality surveys on Opossum and Valley Creeks reveal that pollutants enter these streams from both point and non-point source activities. Dissolved oxygen concentrations upstream of the confluence of Opossum/Valley revealed oxygen deficits (indicating some biological activity). It must be indicated that as a result of the biological surveys discussed elsewhere in this document, only limited biological activity occurs in either of these streams. After the junction of the two streams, dissolved oxygen deficits and/or BOD data indicate continued biological activity and a high reaeration potential.

The results of the water quality surveys with regard to carbonaceous and nitrogenous oxygen demand and the dissolved oxygen concentrations for Opossum and Valley Creeks (fall survey) are presented in Figures 3-25, 3-26, and 3-27.

The concenctrations of zinc and iron drop off significantly with distance down Opossum and Valley Creeks.

Generally, Opossum and Valley Creeks must be characterized as streams conducting large quantities of organics and nitrogenous compounds capable of consuming significant quantities of oxygen. The contribution of pollutants to these receiving streams results from point and non-point source discharges.

Existing conditions occurring on Village Creek can be characterized by streams conducting large quantities of organic and nitrogenous oxygen-consuming materials with a substantially lower impact on dissolved oxygen deficit due to the presence of inhibitory materials. Dissolved oxygen concentrations measured on Village Creek were low (approaching 0 mg/l) in certain portions of the stream upstream of Bayview Lake.

During the period of this investigation, large quantities of primary treated municipal wastes were being discharged to Village Creek as a result of the extensive construction activities occurring at wastewater treatment facilities in the Ensley area. Concentrations of many pollutants appeared to be high above the discharges of the municipal plant and the U. S. Steel facilities on Village Creek. As previously indicated, the decay of carbonaceous materials did not appear to be as inhibited on this stream as on Valley Creek and nitrification appeared to be occurring in those segments of Village Creek in which adequate oxygen was present for nitrifier activity.

Inspection of these data through Bayview Lake and the lower end of Village Creek reveals that Bayview Lake served as a sink for pollutants and tends to stabilize materials prior to their discharge to the lower segments of Village Creek. Additionally, high reaeration as a result of discharge over the dam on Bayview Lake and the high reaeration occurring in the lower portions of Village Creek

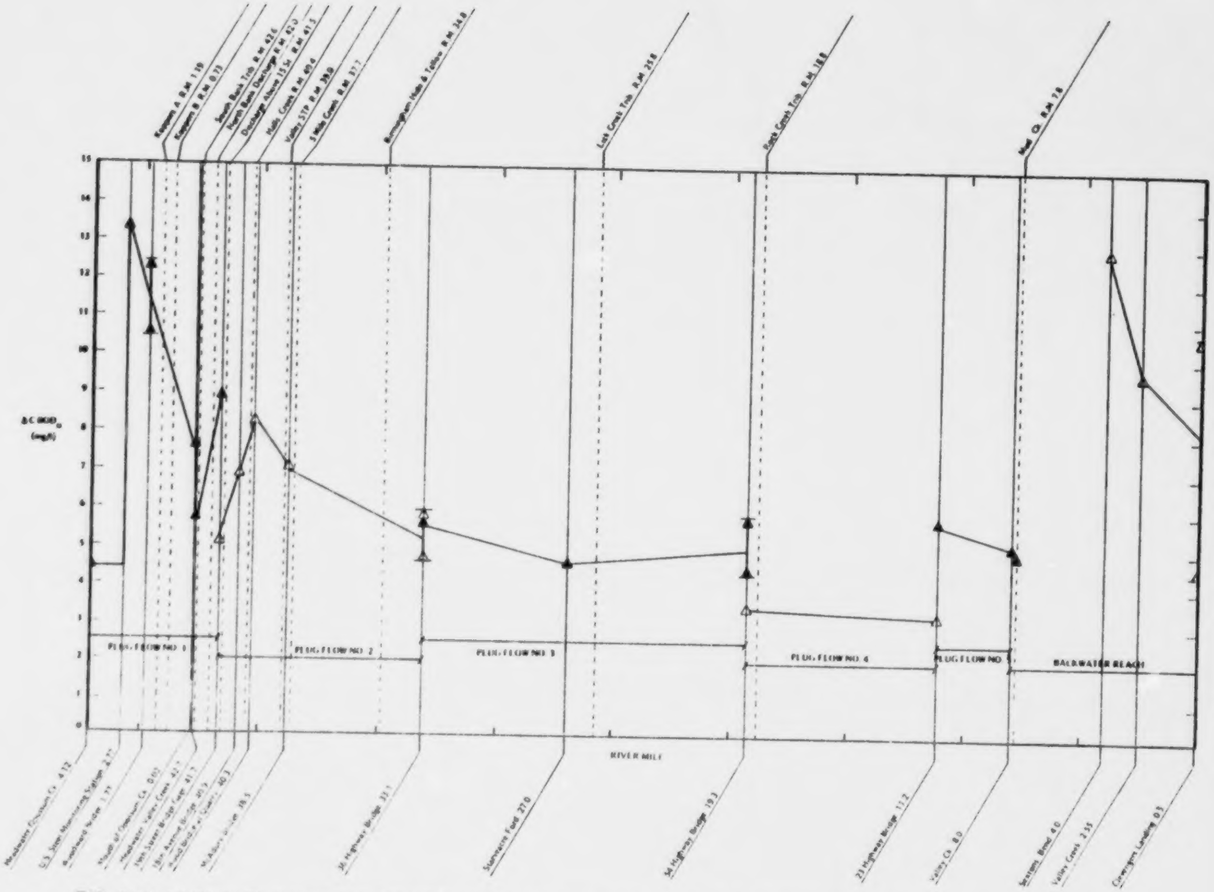


FIG. 3-25. ULTIMATE CARBONACEOUS OXYGEN DEMAND – OPOSSUM AND VALLEY CREEKS – FALL SURVEY

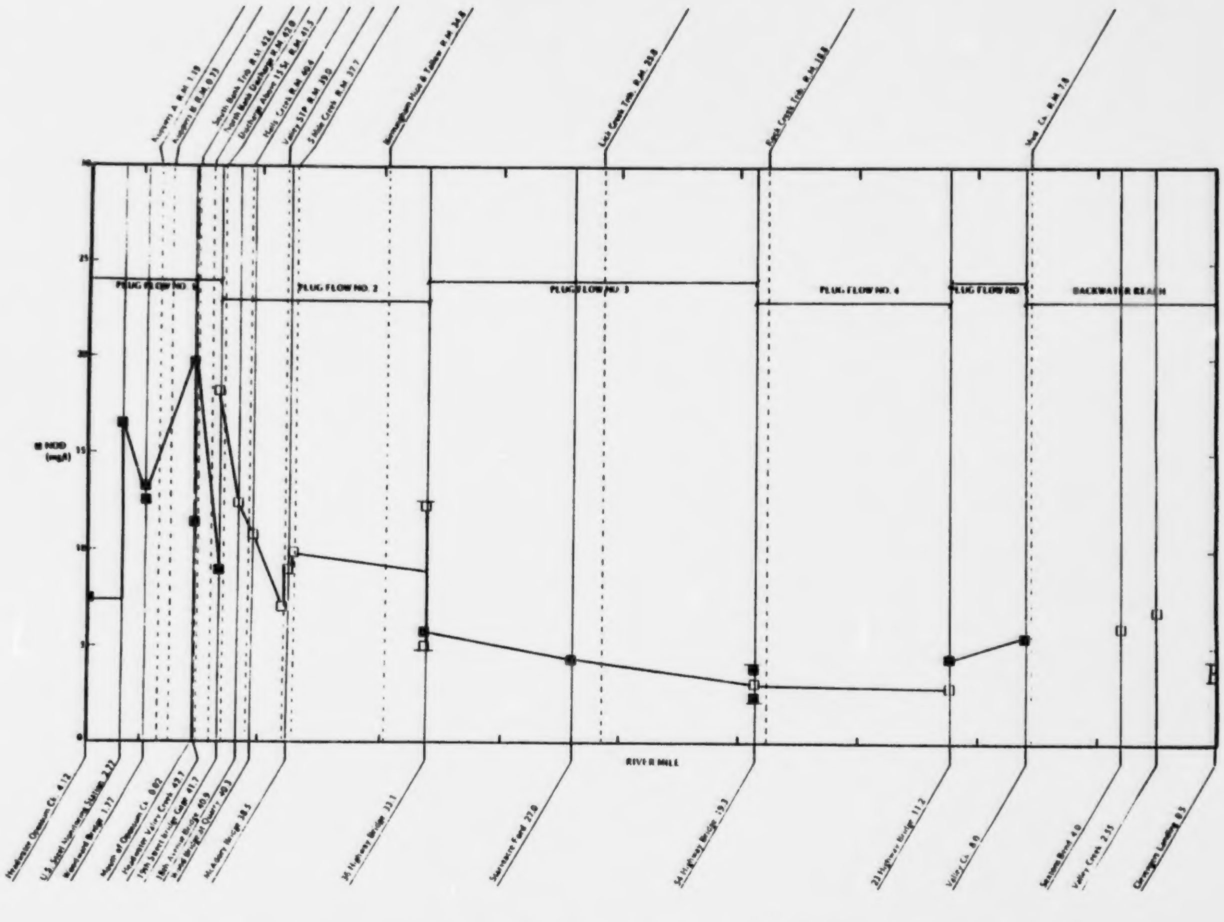


FIG. 3-26. NITROGENOUS OXYGEN DEMAND – OPOSSUM AND VALLEY CREEKS – FALL SURVEY

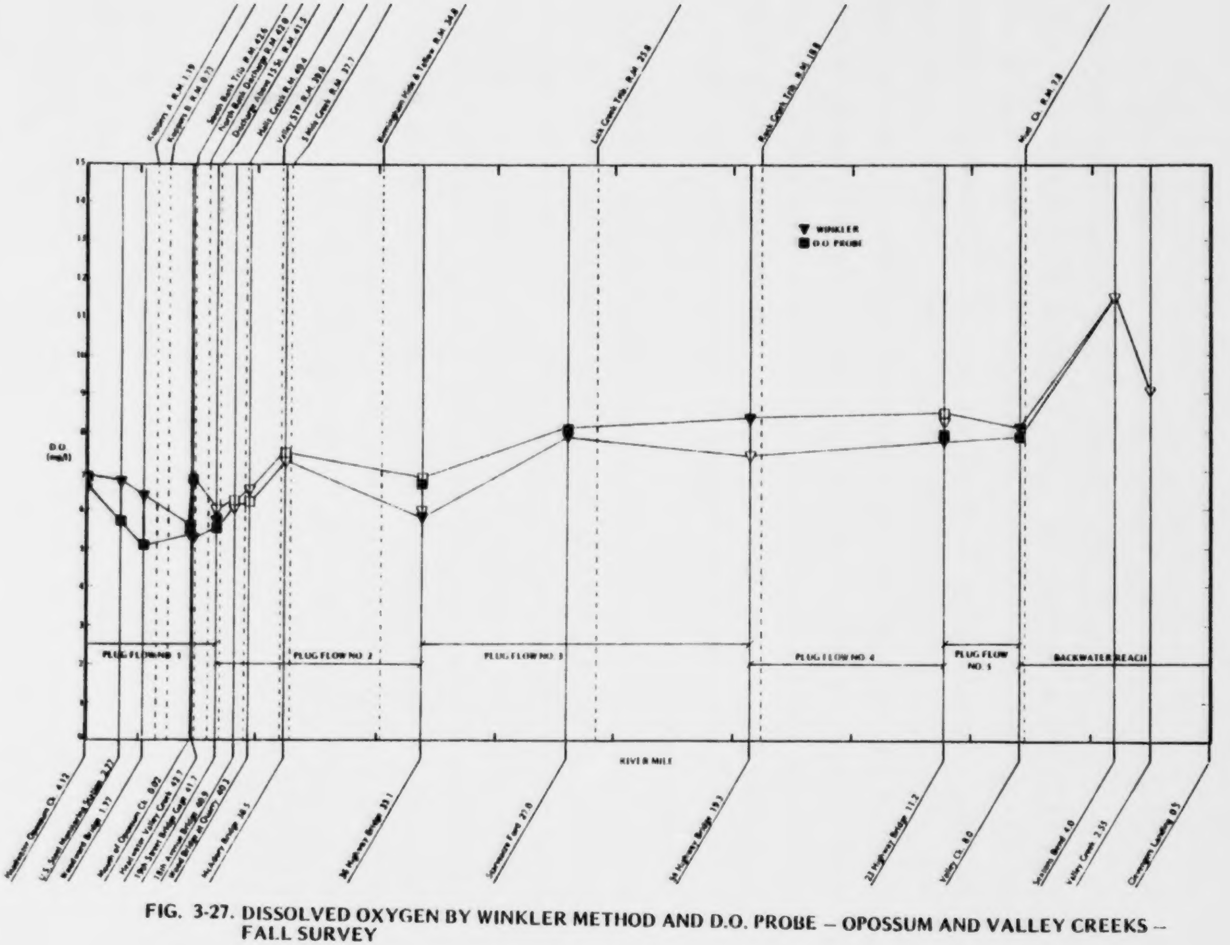


FIG. 3-27. DISSOLVED OXYGEN BY WINKLER METHOD AND D.O. PROBE – OPOSSUM AND VALLEY CREEKS – FALL SURVEY

tend to sustain dissolved oxygen levels which under other conditions would be substantially suppressed as a result of the biological activity of the large quantities of nitrogenous and organic oxygen-consuming materials.

3.1.9.2.2. Existing Conditions on Bankhead Reservoir

Surveys were conducted on Bankhead Reservoir to establish existing water quality conditions and to evaluate the influence of Village and Valley Creeks on Bankhead Lake. The majority of contaminant concentrations in Bankhead Lake were found to increase below the confluences of Village and Valley Creeks. However, high concentrations of zinc and iron were measured upstream of the confluence with Village Creek in Bankhead Reservoir. The pollutants observed in Village and Valley Creek are substantially diluted by the larger receiving body. The dissolved oxygen levels were not reduced below 7.1 mg/l during any of the measurements of surface water taken in this investigation.

In summary, it appears that Opossum, Valley, and Village Creeks all are substantially influenced by point and non-point discharges in the Birmingham area. The poor water quality condition occurring in each of these receiving streams will preclude the accurate projection of improved water quality conditions and discharge levels. It further appears that the contaminants being discharged to Village, Valley, and Opossum Creeks influence these streams throughout their entire length and contribute substantially to the pollution load occurring in Bankhead Reservoir.

3.1.9.3. Groundwater Quality

A number of wells have been completed and are operated within Jefferson County. Chemical parameters have been analyzed for some of these wells and for a number of springs by the Alabama Geologic Survey (Table 3-16).

TABLE 3.16

CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS AND SPRINGS IN JEFFERSON COUNTY

Water-bearing unit (geologic unit and rock type): Geologic unit; ℙpv, Pottsville Formation; ℙMpw, Parkwood Formation; Ml, Floyd Shale; Mb, Bangor Limestone; Mh, Hartselle Sandstone; Mfp, Fort Payne Chert; Oc, Chickamauga Limestone; OCcu, Chepultepec Dolomite and Copper Ridge Dolomite undifferentiated; Ck, Ketona Dolomite; Ce, Conasauga Limestone. Rock type: ch, chert; dol, dolomite; ls, limestone; sh, shale; ss, sandstone.

				Milligrams per liter													Hardness as $CaCO_3$				Temperature	
Well Owner	Date of collection	Water-bearing unit	Well depth (feet)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Calcium, magnesium	Noncarbonate	Specific conductance (micromhos at 25°C)	pH	°C	°F
Town of Trafford	1950	ℙpv, ss	300	33.1	1.5	20.7	9.8	--	--	160.4	0	15.3	14.2	--	--	217.0	95.7	--	--	7.2	--	--
Town of Trafford	1952	ℙpv, ss	300	--	.4	28.3	9.2	--	--	105.1	.0	11.7	8.7	--	--	274.0	104.4	--	--	7.8	--	--
Warrior Ice Company	10-25-28	ℙpv, ss	701	13	1.3	40	14	23	3.2	153	0	4.2	50	--	0.2	288	157	32	--	--	16	62
Birmingham Water Works	11-29-50	Ck, dol	208	10.1	.6	26.9	14.0	4.0	--	82.6	.0	4.3	6.2	--	--	129.0	128.0	--	--	7.6	--	--
Birmingham Water Works	1951	Ck, dol	208	10.3	.15	25.7	11.1	--	--	134.2	0	3.2	7.1	--	--	136.0	--	--	--	7.3	--	--
Birmingham Water Works	9-2-52	Ck, dol	208	8.9	.12	32	16	1.2	.4	166	0	2.0	2.5	0.0	3.2	143	146	10	266	7.6	18	64
Birmingham Water Works	12-12-69	Ck, dol	208	9.2	.03	34	18	1.8	1.0	186	0	4.8	2.7	.0	1.7	155	159	6	269	7.5	--	--
City of Trussville	2-8-68	Mb, ls	219	--	--	--	--	--	--	156	0	--	2.8	--	--	--	161	33	335	7.8	14	58
City of Trussville	2-9-68	Mb, ls	219	--	--	--	--	--	--	156	0	--	2.8	--	--	--	79	0	339	7.7	--	--
City of Trussville	1960	Mb, ls	159	10.0	.5	50.1	1.5	--	--	158.6	0	.9	8.3	--	--	128.0	135.5	--	--	7.7	--	--
City of Trussville	8-24-36	Mb, ls	186	--	.7	39.3	3.7	2.4	.03	122.0	0	18.9	3.7	--	.05	--	113.4	--	--	6.65	--	--
City of Trussville	8-29-52	Mb, ls	186	5.1	.10	48	2.7	1.5	.7	152	0	2.2	3.2	.1	.9	143	131	6	245	7.6	17	63
City of Trussville	12-11-69	Mb, ls	186	6.0	.00	44	2.6	1.7	1.2	149	0	3.3	2.4	.1	.0	135	121	0	215	7.3	--	--
City of Trussville	3-24-36	Mb, ls	186	--	.2	32.5	3.3	4.2	--	127.5	0	2.3	6.5	--	--	--	94.8	--	--	7.4	--	--
Birmingham Water Works	11-26-57	OCcu, dol	237	6.3	.1	31.2	14.0	.2	.6	164.7	0	2.0	4.0	trace	1.6	225.2	136.8	--	--	7.5	--	--
Birmingham Water Works	12-12-69	OCcu, dol	237	8.1	.05	32	15	1.0	1.2	164	0	2.8	2.8	.1	1.5	146	142	7	251	7.4	16.0	61
City of Trussville	4-25-50	Mb, ls	320	7.8	.16	54.6	3.5	1.9	--	100.1	.0	3.6	5.3	--	--	169.0	154.1	--	--	7.4	--	--
City of Trussville	9-17-52	Mb, ls	320	13	2.1	49	3.9	1.9	.8	170	0	3.4	2.5	.0	1.1	160	138	0	268	7.6	20	67
City of Trussville	12-11-69	Mb, ls	320	7.8	.00	55	3.1	2.4	1.0	172	0	3.9	4.0	.1	3.0	163	150	9	274	7.3	15.0	59
Birmingham Water Works	1953	OCcu, dol	264	8.5	.3	17.6	9.6	--	--	61.7	.0	3.3	7.9	--	--	79.0	84.8	--	--	7.6	--	--
Birmingham Water Works	7-26-58	OCcu, dol	157	8.5	.1	33.0	4.0	--	--	158.6	0	1.2	6.8	--	--	132.0	90.0	--	--	7.6	--	--
Birmingham Water Works	12-12-69	OCcu, dol	157	8.4	.02	30	15	1.2	.8	162	0	2.7	2.3	.1	1.4	142	137	4	251	7.4	16.0	61
Town of New Castle	3-17-50	ℙpv, ss	450	12.4	1.3	45.2	9.7	--	--	110.2	0	30.9	3.5	--	--	225	157.8	--	--	7.0	--	--
Town of New Castle	9-26-52	ℙpv, ss	450	14	2.9	24	11	75	3.1	287	0	28	3.8	.0	.4	305	105	0	491	8.0	18	65
Birmingham Water Works	6-6-46	OCcu, dol	160	6.3	.3	24.8	8.9	5.4	1.9	123.1	0	trace	9.9	--	.3	--	100.7	--	--	7.6	--	--
Birmingham Water Works	1-29-47	OCcu, dol	160	10.8	.25	25.4	12.7	--	--	133.0	0	.8	2.8	--	--	143.0	115.7	--	--	7.3	--	--
Birmingham Water Works	8-28-52	OCcu, dol	160	8.4	.02	29	14	.8	.2	145	0	1.2	2.8	.1	3.4	129	130	11	235	7.6	18	64
Birmingham Water Works	10-2-52	Ck, dol	s	9.7	.47	32	18	1.2	.6	175	0	1.6	2.8	.1	.5	144	154	10	278	8.0	16	62
Birmingham Water Works	1960	Ck, dol	s	5.5	.2	42.2	21.9	1.9	2.2	236.4	0	8.2	--	--	--	321.8	197.6	--	--	7.5	--	--
Birmingham Water Works	1-11-61	Ck, dol	s	--	.1	--	--	--	--	--	--	--	10.6	--	--	--	208	--	--	6.2	15	59
Birmingham Water Works	1-15-61	Ck, dol	s	--	--	--	--	--	--	--	--	--	7.1	--	--	--	210	--	--	6.9	--	--

3.1.9.4. Non-Point Water Quality

A storm event occurred on March 28, 1977, over the Opossum Creek watershed. The rainfall was 0.67 inches. The runoff from this storm was sampled by AWARE, Inc. in an attempt to characterize the loadings to Opossum Creek as a result of non-point sources.

The Opossum Creek watershed is shown in Figure 3-28. This watershed consists of all areas tributary to the U. S. Steel monitoring station at river mile 2.77. This is a total tributary area of 10.05 sq mi (6,450 acres). Of this total, 3.48 sq mi is in lower to lower-middle class residential housing; 3.35 sq mi is in the heavy industrial land use category. The remaining land is primarily unused and classified as fields or wooded areas.

The rain storm that occurred on March 28, 1977, between 8:10 a.m. and 11:30 a.m. was the fifth storm event to have occurred over the watershed during the month of March. The distribution and intensities of the preceding storms are shown in relationship to the evaluated storm event in Figure 3-29. The preceding storm events were greater in magnitude than the measured event and spaced so that the antecedent moisture level in the surface soil of the watershed was fairly high. The three preceding storms could be expected to have provided a reasonable "flushing" effect of surface pollutants by both their magnitude and the intervals between them. A time of nearly 6 3/4 days elapsed between the last of the three major storms and the smaller storm event that was monitored.

Figure 3-30 is the combined storm hyetograph-hydrograph for the March 28, 1977, storm. The rainfall event had a duration of approximately 3 hr at an average rate of 0.22 in/hr. The hydrograph peak occurred 4 hr after commencement of significant rainfall and 1 hr after cessation of significant rainfall. The surface runoff accounts for approximately 23 percent of the total rainfall which was consistent over the general area (0.67 in. measured on site/0.66 in. at Birmingham airport).

Eight water quality samples for the parameters shown in Table 3-17 were taken during the event. The stormwater hydrograph is shown in Figure 3-30. Six of the water quality samples were taken on

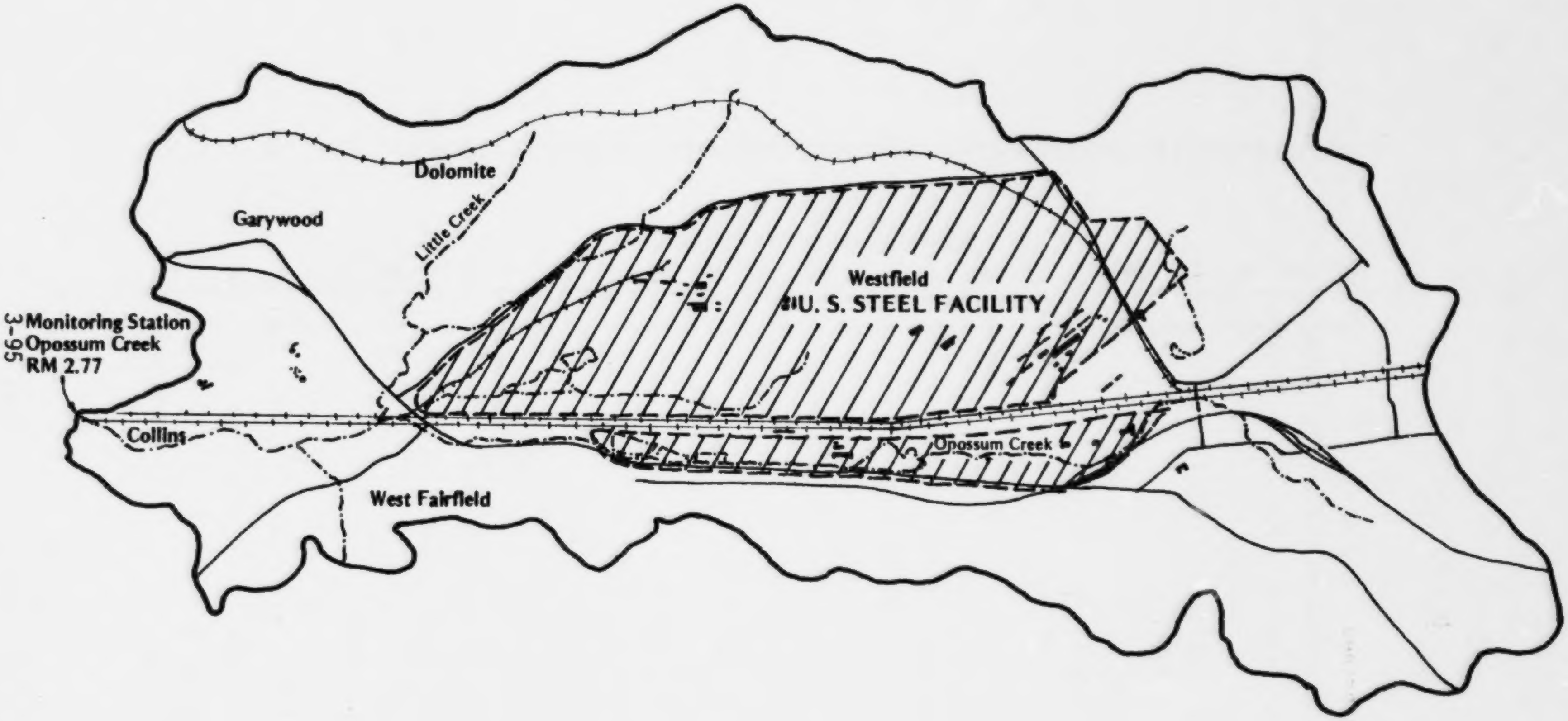

Monitoring Station
Opossum Creek
RM 2.77
Garywood
Dolomite
Little Creek
Westfield
U. S. STEEL FACILITY
Collins
West Fairfield
Opossum Creek

FIG. 3-28. OPOSSUM CREEK WATERSHED TRIBUTARY TO MONITORING STATION AT RM 2.77 – TRIBUTARY AREA 10.08 SQUARE MILES

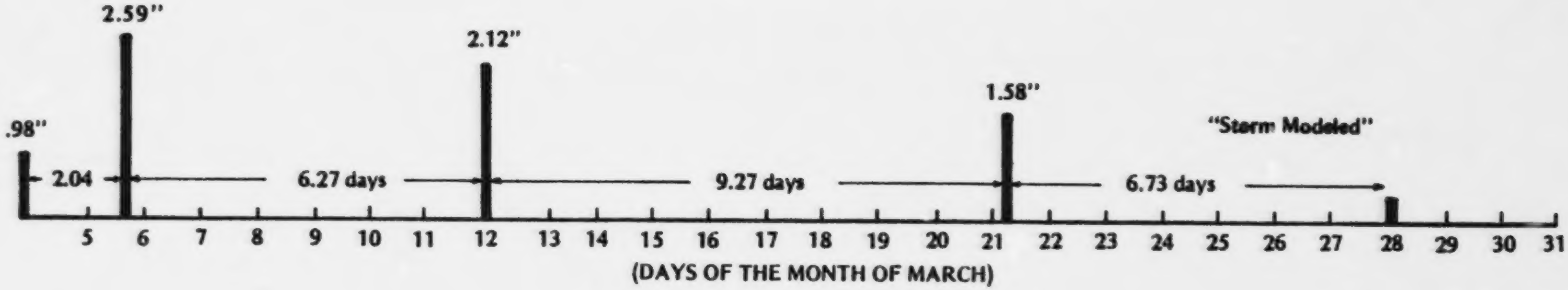


FIG. 3-29. STORM EVENTS AND MAGNITUDES IN MARCH, 1977 PRECEEDING MARCH 28 STORM

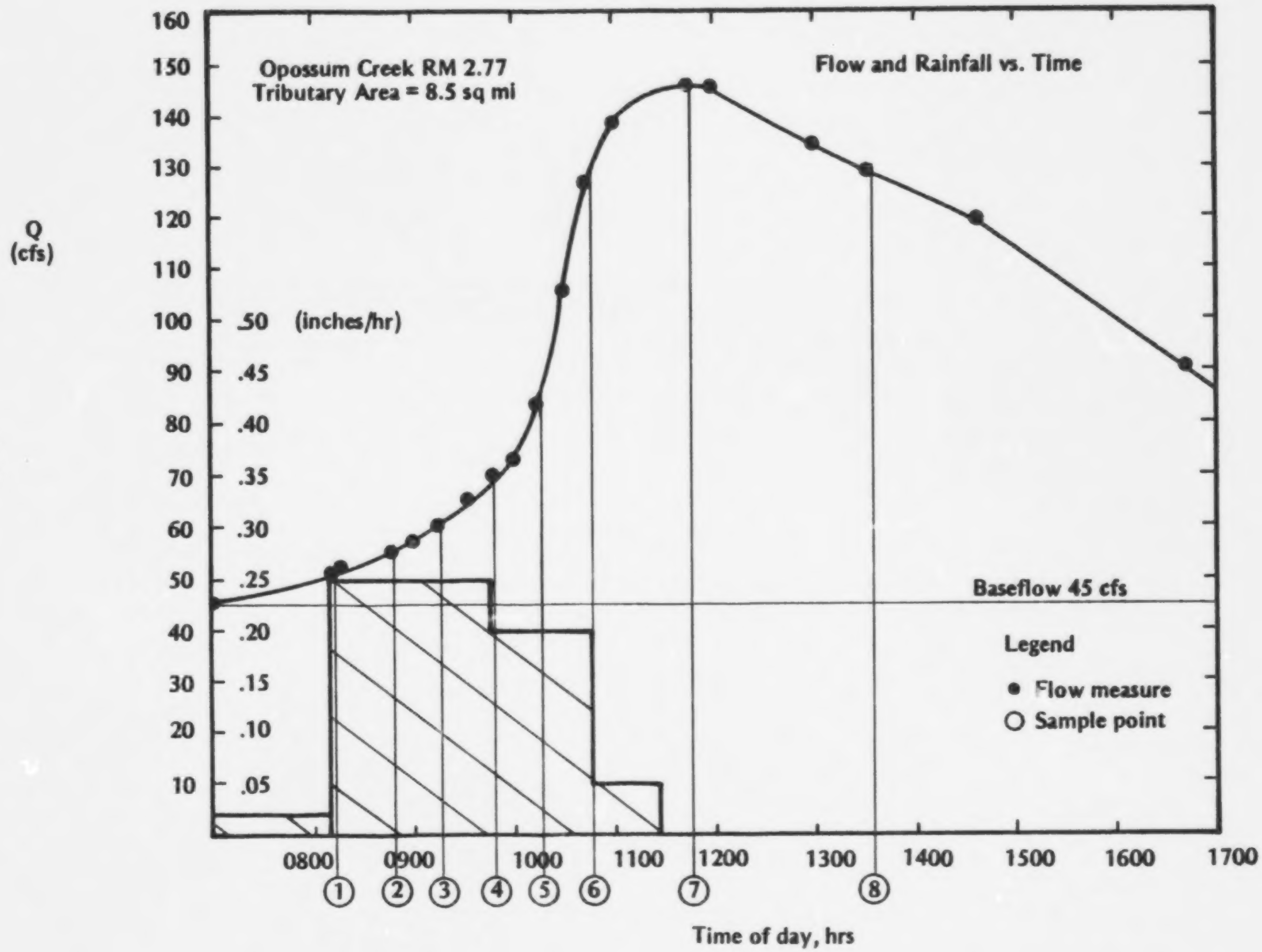


FIG. 3-30. STORMWATER HYETOGRAPH-HYDROGRAPH OPOSSUM CREEK MONITORING STATION RM 2.77 March 28, 1977

TABLE 3-17

MEASURED WATER QUALITY PARAMETERS - OPOSSUM CREEK RM 2.77 - MARCH 28, 1977 STORM EVENT

Sample No.	Time (hr)	Alk. (mg/l)	Cl (mg/l)	CN (mg/l)	F (mg/l)	Hard (mg/l)	NH_3-N (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	TKN (mg/l)	O&G (mg/l)	pH	Phenol (mg/l)	*o-PO_4 (mg/l)	T-PO_4 (mg/l)	SS (mg/l)	TDS (mg/l)	SO_4 (mg/l)	Q (cfs)	$CBOD_u$ (mg/l)	NOD (mg/l)	Cd (mg/l)	Cr (ug/l)	Cu (ug/l)	Fe (mg/l)	Mn (mg/l)	Sn (mg/l)	Zn (mg/l)
1	0812	61	24.9	0.11	1.39	307	.2	1.66	2.20	12.2	.6	7.1	.012	.06	0.40	46	480	202	51.7	24.1	55.3	<.03	6	12	2.34	0.52	<.06	.27
2	0848	60	24.2	0.15	1.88	297	6.4	.83	1.89	10.5	.4	7.2	.012	.03	0.40	17	432	211	55.8	25.2	47.6	.07	6	9	1.91	0.55	"	.22
3	0916	58	22.9	0.14	1.00	295	3.7	.69	1.90	10.5	.2	7.2	.021	.03	0.40	26	446	189	61.6	30.3	47.6	.07	5	10	2.75	0.55	"	.27
4	0946	57	20.9	0.11	1.10	302	6.4	1.05	1.54	6.7	1.2	7.2	.059	.07	1.3	50	482	208	69.8	32.0	30.7	.04	18	15	4.03	0.65	"	.42
5	1015	61	18.1	0.15	1.30	292	7.2	8.15	1.18	10.4	10.2	7.2	.175	.05	.52	265	658	181	70.0	32.3	46.3	.07	107	43	21.2	1.14	"	2.46
6	1045	59	16.5	0.09	0.90	260	1.3	3.81	1.02	10.1	6.6	7.2	1.60	.03	.65	410	734	179	122.3	39.2	44.9	.07	156	39	25.8	1.01	"	3.46
7	1145	48	14.9	0.10	0.90	227	6.4	.94	.92	17.6	5.4	7.2	4.45	.03	.65	442	695	134	145.5	41.6	77.2	.11	181	42	20.8	1.51	"	5.4
8	1333	50	17.1	0.10	1.48	222	13.0	.69	1.53	16.1	.2	7.2	3.14	.04	.65	211	524	149	129.4	35.6	71.4	<.03	34	27	9.5	0.52	"	1.36

*Phenol discharges of 1.60, 4.45, and 3.14 mg/l are atypical. No explanation can be given for these atypical phenol concentrations. They have not been measured at such high levels before or since these figures were recorded, even during precipatation events.

the rising side of the hydrograph both to establish pre-storm water quality conditions and to capture the first flush of the water quality parameters. Samples were also taken at what proved to be the peak of the stormwater hydrograph and on the declining side of the hydrograph.

The peak mass-rates of many of the water quality parameters occurred simultaneously with the stormwater hydrograph peak (Figures 3-31, 3-32, and 3-33) and declined more precipitously than the stormwater hydrograph. This may indicate that for many of the parameters, the storm "flushed" portions of the watershed of the surface loading accumulated since the last major storm. A list of important parameters and their fluctuations during the stormwater discharge follows in Table 3-18. The weight-rates recorded at times 0812 and 0845 reflect the ambient water quality conditions within Opossum Creek prior to the introduction of appreciable portions of the non-point load due to rainfall. The peak weight-rates recorded at times 1145 and 1333 for the heavy metals are a factor of 10 or more greater than the ambient weight-rates recorded in the stream before the stormwater flow.

Organics such as oil and grease, phenol, and cyanide vary in their response to the storm. Oil and grease displays a definite early peak and returns to ambient concentrations in the stream. Phenol rises to high levels and gradually declines with recession of the storm hydrograph. The BOD and nitrogen series (except nitrate) parameters do not have an early response to the hydrograph but increase and decrease with the peak flow. This suggests that for some of these important parameters, the rainfall recorded was inadequate to mobilize and remove the pollutant. Concentrations and weight rates are shown for $CBOD_u$ and NOD in Table 3-19.

The stormwater quality study of the March 28, 1977 storm established the loading rates for the majority but not all of the water quality parameters within the watershed because the flushing effect of the storm may have been inadequate to fully remove accumulated waste loadings.

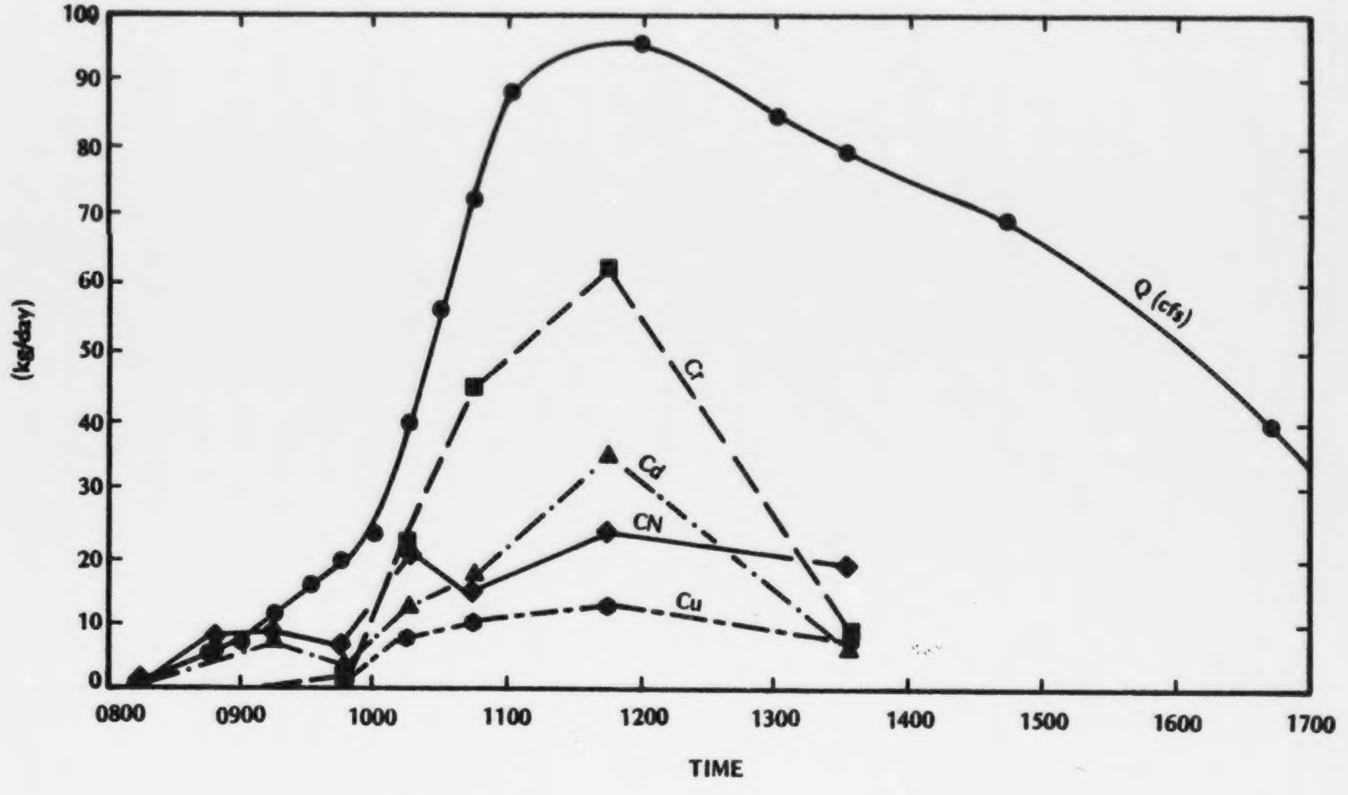


FIG. 3-31. WEIGHT RATES HEAVY METALS DURING 3/28/77 STORM HYDROGRAPH OPOSSUM CREEK RM 2.77

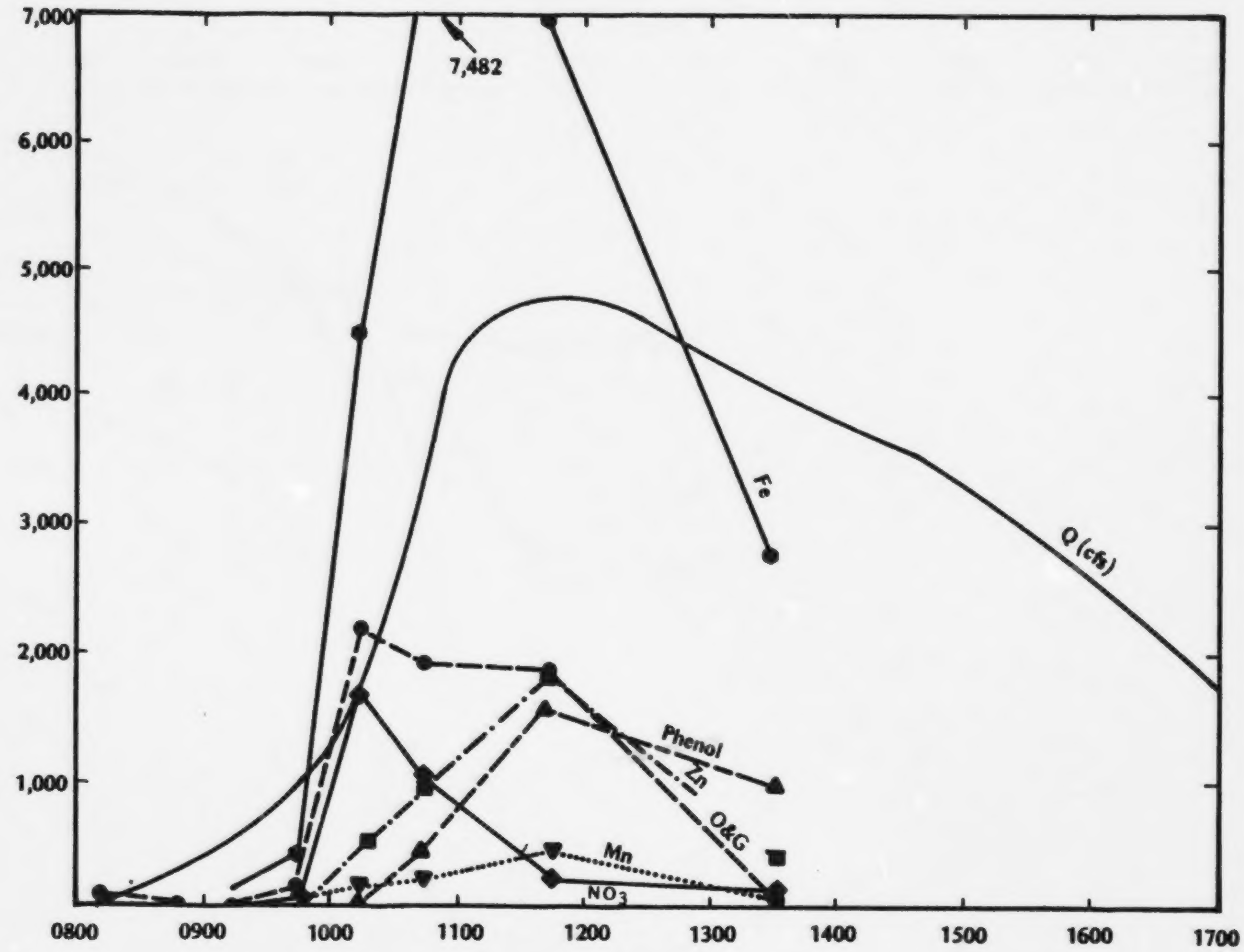


FIG. 3-32. WEIGHT-RATES OF PRODUCTION OF WATER QUALITY PARAMETERS MARCH 28, 1977 STORM AT OPOSSUM CREEK RM 2.77

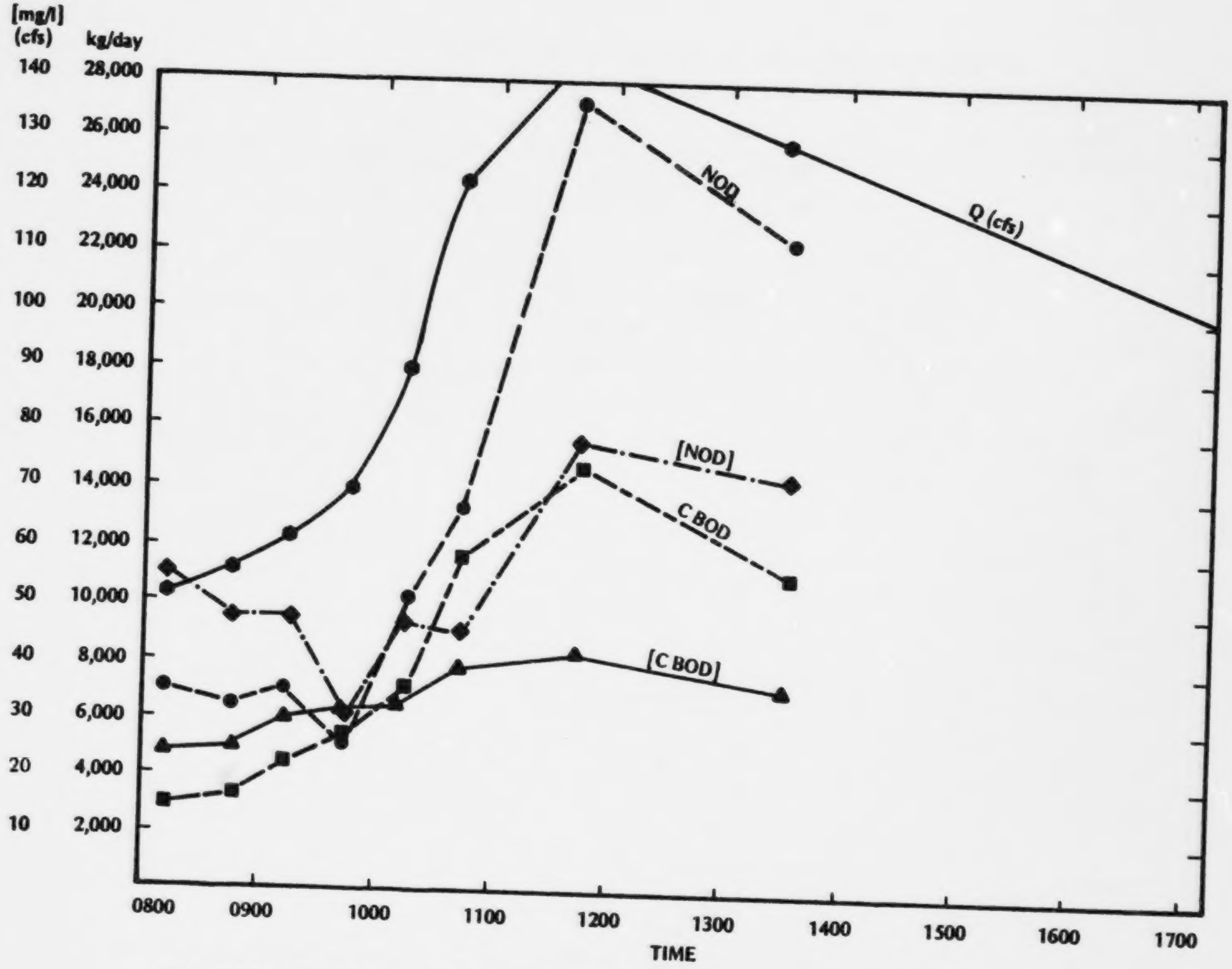


FIG. 3-33. CONCENTRATIONS AND WEIGHT RATES OF C BOD_u and NOD MEASURED DURING THE STORM HYDROGRAPH MARCH 28, 1977 OPOSSUM CREEK RM 2.77

TABLE 3-18

WEIGHT RATES FOR SELECTED WATER QUALITY PARAMETERS - OPOSSUM CREEKS
RIVER MILE 2.77, MARCH 28, 1977 - STORM EVENT

		BOD		Nitrogen Series							Heavy Metals					
		[CBOD$_u$]	[CBOD$_u$]	[NH$_3$]	[NO$_2$]	[TKN]	[NO3]	[O & G]	[Phenol]^b	[Cyanide]	[Cd]	[Cr]	[Cu]	[Fe]	[Mn]	[Zn]
Time (Hrs)	Flow (cfs)	(mg/l)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)
0812	[51.7]a	24.1	3,014	23.1	271	1,526	208	75.0	1.5	13.8	<3.75	0.75	1.50	293	65	33.0
0815	52.0															
0846	55.5															
0848	[55.8]	25.2	3,401.5	141.2	255	1,417	112	54.0	1.6	20.3	9.45	0.81	1.21	258	72	29.7
0900	57.2															
0916	[61.5]	30.3	4,515	110.0	283	1,565	103	29.8	3.1	20.9	10.4	0.75	1.50	410	82	40.2
0932	66.0															
0946	[69.8]	32.0	5,400	177.0	260	1,131	177	203.0	4.1	18.6	6.8	3.04	2.53	680	110	70.9
1000	73.5															
1015	[90.0]	32.3	7,030	241.5	257	2,264	1,774	2,220.0	38.1	32.7	15.2	23.3	9.4	4,615	248	536.0
1030	106.0															
1045	[122.3]	39.2	11,600	139.4	302	2,988	1,127	1,953.0	473.4	26.6	20.7	46.2	11.5	7,632	299	1,024.0
1100	138.5															
1145	[145.5]	41.6	14,900	364.0	272	6,122	327	1,870.0	1,550.0	34.8	38.3	63.0	14.6	7,235	525	1,080.0
1200	145.5															
1300	134.5															
1333	[129.42	35.6	11,100	466.6	479	5,080	216	63.0	983.0	31.3	<9.4	10.6	8.5	2,970	183	426.0
1437	119.5															
1642	90.5															

a[] means interpolated flow.

b - Phenol discharges at 1045 hrs, 1145 hrs, and 1333 hrs are based on the atypical measurements recorded in Table 6-25

TABLE 3-19

$CBOD_u$ and NOD - MARCH 28, 1977 STORM EVENT

Time (hrs)	Q (cfs)	$[CBOD_u]$ (mg/1)	[TKN] (mg/1)	$[NO_2]$ (mg/1)	[NOD] (mg/1)	$\{CBOD_u\}$ (kg/day)	$\{NOD\}$ (kg/day)
0812	51.7	24.1	12.2	2.2	55.27	3,014	6,912
0848	55.8	25.2	10.5	1.89	47.56	3,401	6,420
0916	61.6	30.3	10.5	1.90	47.57	4,515	7,088
0946	69.8	32.0	6.7	1.54	30.72	5,403	5,187
1015	90.0	32.3	10.4	1.18	46.34	7,032	10,089
1045	122.3	39.2	10.1	1.02	44.87	11,597	13,274
1145	145.5	41.6	17.6	0.92	77.23	14,642	27,182
1333	129.4	35.6	16.1	1.53	71.41	11,143	22,353

[] denote concentration

{ } denote mass rates

The study does not indicate that non-point sources will dominate the observed water quality of the stream during rainfall events of a modest magnitude or greater. The watershed, composed of nearly equal portions of highly urbanized, highly industrialized, and undeveloped land will contribute significant quantities of toxic and oxygen consumptive compounds during the storm events which may be a significant source of the measured sediment parameter values and impaired biologic conditions. The known problems of major point source contributions and high fluctuations of these loadings were exceeded by the greater fluctuations and magnitudes measured during the March 28, 1977 storm event. A second storm event was sampled during the fall survey at the 19th Street Station in Valley Creek. The results of this survey are reported in the Technical Support Document.

3.1.10. Biology

Due to the fact that the proposed new source will be constructed on an existing industrial site and will not require the clearing of previously undeveloped properties, the development of a biological inventory for the proposed plant site is not deemed pertinent to this investigation. However, all available literature has been reviewed in order to determine if the plant site falls within the transient range of any rare or endangered species of terrestrial and aquatic fauna and flora. Additionally, field studies were conducted in order to determine the status of the aquatic communities associated with the streams impacted by the proposed modernization project, i.e., Opossum Creek, Valley Creek, Village Creek, and Bankhead Reservoir. Biological sampling stations are described in Table 3-20, and their locations are depicted in Figure 3-34. The results of these studies along with the available literature are presented and discussed in detail in the Technical Support Document.

From a biological standpoint, the three streams of the Black Warrior Drainage Basin included in this survey are all stressed. These conclusions are based upon the following:

TABLE 3-20

DESCRIPTION OF SAMPLING STATIONS

Station No.	Location
1	Opossum Creek @ the end of I-59 River mile 4.12
2	Opossum Creek just below U.S.S. Monitoring Station - River mile 2.8
3	Opossum Creek just below Koppers - River mile 1.8
4	Opossum Creek 100 yd upstream from Valley Creek Confluence - River mile 0.1
2	Valley Creek @ First Bridge upstream from the Confluence with Opossum Creek - River mile 43
1	Valley Creek - 100 yd upstream from Confluence with Opossum Creek - River mile 42.7
3	Valley Creek @ 19th Street Bridge - River mile 41.7
4	Valley Creek @ Highway 54-36 Intersection - River mile 38.5
5	Valley Creek @ Highway 36 - River mile 33.1
7	Valley Creek @ Highway 54 - River mile 19.5
8	Valley Creek @ Highway 23 Bridge - River mile 11.2
9	Valley Creek Slack Water Area - River mile 0.2-3.0
9A	Valley Creek Confluence with Bankhead Reservoir - at the point on upstream side of Confluence
10	Black Warrior River, approximately 1 mile upstream from the Confluence with Valley Creek - River mile 382

TABLE 3-20 (Cont'd)

DESCRIPTION OF SAMPLING STATIONS

Station No.	Location
11	Black Warrior River, approximately 1 mile downstream from the Confluence with Valley Creek @ bridge piling #6 - River mile 380
1	Village Creek @ Avenue F, Birmingham above U. S. Steel - River mile 28.8
2	Village Creek @ Docena Road - River mile 25.5
3	Embayment @ Confluence with Bayview Lake (south bank) - River mile 22.6
4	Bayview Lake (east bank) - River mile 22.6
5	Village Creek @ Shady Grove Road - River mile 17.3
6	Village Creek below Woodruff Bridge - River mile 9.7
7	Upstream of Alabama Power @ bridge crossing - River mile 2.5
8	Upstream of Confluence with Locust Fork - LF RM 406
9	Downstream of Confluence with Locust Fork - LF RM 404

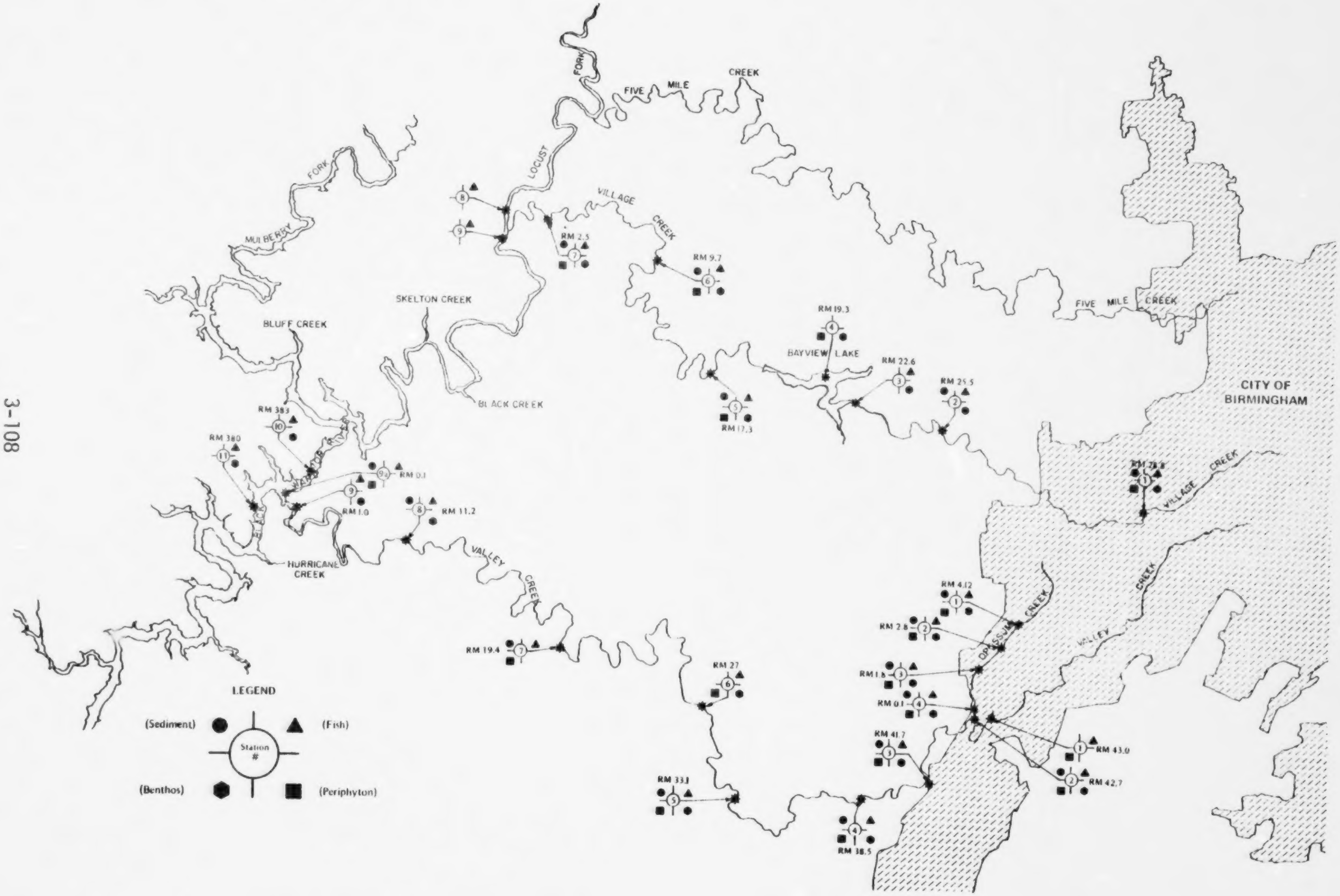

FORK
FIVE MILE CREEK
LOCUST
VILLAGE CREEK
MULBERRY FORK
SKELTON CREEK
BLUFF CREEK
BLACK CREEK
BAYVIEW LAKE
CITY OF BIRMINGHAM
FIVE MILE CREEK
VILLAGE CREEK
WARRIOR RIVER
BLACK
HURRICANE CREEK
VALLEY CREEK
OPOSSUM CREEK
VALLEY CREEK
RM 2.5
RM 9.7
RM 19.3
RM 22.6
RM 25.5
RM 17.3
RM 28.8
RM 383
RM 380
RM 0.1
RM 1.0
RM 11.2
RM 19.4
RM 27
RM 33.1
RM 38.5
RM 41.7
RM 0.1
RM 1.6
RM 2.8
RM 4.12
RM 43.0
RM 42.7
1
2
3
4
5
6
7
8
9
9a
10
11
LEGEND
(Sediment) ●
▲ (Fish)
Station #
(Benthos) ⬢
■ (Periphyton)

FIG. 3-34. LOCATION OF BIOLOGICAL SAMPLING STATIONS IN THE STUDY AREA

Fish. The numbers of fish collected by electroshocking and seining efforts were exceptionally low with 38 percent of the stations sampled yielding no fish at all (Table 3-21). Those fish collected from Valley and Village Creeks were exclusively forage or rough fish. No fish were collected from Opossum Creek. In these streams, Gambusia were collected in greatest numbers and its presence as a dominant species is a strong indication of pollution (Ramsey, 1975). The absence of some particular species is also indicative of a stressed situation. With the good habitat available for sedentary species in Valley and Village Creeks species such as Percina and Etheostoma (darters) as well as sculpins (Cottus) should be found in an unpolluted situation.

Levels of selected heavy metals were determined in livers, flesh, and whole fish and are reported in Table 3-22. Comparison of these data with in-stream concentrations (see Water Quality Section) reveals that all of these metals are bioaccumulated to an appreciable extent. Evaluation of the data revealed that the values for cadmium were atypically high when compared to other heavy metals. Consequently, a second survey was performed at which time zinc was also run for verification. The results of the second survey are presented in Table 3-23.

Invertebrates. The use of diversity indices allows comparison of one population to another. "A community dominated by a few very common species, with only a few species with small to very small populations is characteristic of much more severe pollution than a community with a few very common species and many species with small to very small population" (Patrick, 1969).

> "In general, high diversity at the various trophic levels, as evidenced by numerous species with relatively small populations that are able to maintain themselves in associations over time, has been recognized by many as giving stability to the community, for it increases the flexibility of the community to respond to changing environmental conditions. High diversity is probably also important in predatory-prey relationships......." (Patrick, 1969).

TABLE 3-21

SPECIES COLLECTED AT EACH LOCATION

Species Collected	Opossum Creek Stations				Valley Creek Stations																			
	1	2	3	4	1	2	3	4	5	7	8	9[a]	9A[a]	10[b]	11[b]	1	2	3	4*	5	6	7	8[b]	9[b]
Mosquito Fish (Gambusia affinis)	No Fish Collected	No Fish Collected	No Fish Collected	No Fish Collected	31	8	16	No Fish Collected	1	-	-	-	-	-	-	No Fish Collected	1	No Fish Collected	-	No Fish Collected	No Fish Collected	-	-	-
Golden Shiner (Notemigonus crysoleucas)					-	6	-		-	-	-	2	-	-	-		-		-			-	-	-
Creek Club (Semotilus atromaculatus)					-	1	3		1	-	-	-	-	-	-		-		-			-	1	-
Bluegill (Lepomis machrochirus)					-	-	1		-	-	-	2	34	-	-		-		-			-	-	-
Stoneroller (Campostoma anomalum)					-	-	-		-	2	-	-	-	-	-		-		-			-	-	-
Green Sunfish (Lepomis cyanellus)					-	-	-		-	-	6	2	-	3	5		-		-			7	-	1
Skipjack Herring (Alosa chrysochloris)					-	-	-		-	-	-	3	3	-	1		-		-			-	4	-
Gizzard Shad (Dorosoma cepedianum)					-	-	-		-	-	-	3	14	3	2		-		-			-	23	1
Golden Redhorse (Moxostoma erythrurum)					-	-	-		-	-	-	-	-	3	1		-		-			-	4	4
Blacktail Redhorse (Moxostoma poeilurum)					-	-	-		-	-	-	4	3	4	6		-		-			2	-	6
Black Redhorse (Moxostoma duquesnii)					-	-	-		-	-	-	-	-	-	1		-		-			-	-	7
Large Mouth Bass (Micropterus salmoides)					-	-	-		-	-	-	-	6	-	-		-		-			-	-	-
Spotted Bass (Micropterus punctulatus)					-	-	-		-	-	-	-	1	-	-		-		-			-	-	-
Channel Catfish (Ictalurus punctatus)					-	-	-		-	-	-	-	10	1	-		-		-			-	3	9
Blue Catfish (Ictalurus furcatus)					-	-	-		-	-	-	-	7	-	-		-		-			-	-	-
Carp (Cyprinus carpio)					-	-	-		-	-	-	-	1	-	1		-		-			-	1	-
Bullhead Minnow (Pimephales vililax)					-	-	-		-	-	-	-	1	-	-		-		-			-	-	-
Drum (Aplodinotus grunniens)					-	-	-		-	-	-	-	-	-	1		-		-			-	1	1
Shortnose Gar (Lepisosteus Rafinesque)					-	-	-		-	-	-	-	-	-	1		-		-			-	-	-
White Bass (Morone chrysops)					-	-	-		-	-	-	-	-	-	1		-		-			-	-	-
Warmouth Bass (Chaenobryttus gulosus)					-	-	-		-	-	-	-	-	-	1		-		-			-	-	-
Total Species					1	3	3		2	1	1	6	10	5	11		1		0			2	7	7
Forage - %					100	100	100		100	100	100	83	40	40	27		100					50	43	28
Rough - %					-	-	-		-	-	-	17	40	60	55		-					50	57	72
Game - %					-	-	-		-	-	-	-	20	-	18		-					-	-	-

[a] 6 Net Nights (collected 3/21-3/27, 1977)

[b] 3 Net Nights (collected 5/3-5/4, 1977)

* Gambusia observed but not collected

TABLE 3-22

RESULTS OF HEAVY METAL ANALYSIS ON WHOLE FISH & EXCISED LIVER & MUSCLE

Station	Fish		g(dry wt.)	Cd**	Sn	Fe	Zn	Cu	Cr	Mn
				Metal-(ug/g)						
Station 5	Creek Chub	(Liver)	0.0216		<20.0	350	120	10	<20	10.0
		(Flesh)	0.1659		17.0	63	50	3	5	3.0
		(Whole)	0.1132		110.0	200	203	11	4	39.0
Valley Creek at 19th Street (RM 41.7)	Mosquito Fish	(Whole)	0.1625		63.5	412	330	20	8	57.0
		(Whole)	0.1749		45.0	872	320	13	10	55.0
		(Whole)	0.1242		88.0	1,600	250	7	20	60.0
		(Whole)	0.2278		75.0	295	230	8	6	46.0
Valley Creek at Highway 54 (RM 19.4)	Stoneroller	(Whole)	1.2164		30.1	677	148	10	4	41.0
		(Whole)	0.9861		32.3	1,450	172	10	5	82.0
Valley Creek at Highway 23 (RM 11.2)	Green Sunfish	(Whole)	0.3656		66.9	317	160	10	6	161.0
		(Whole)	0.7026		43.3	139	130	7	3	79.0
		(Whole)	0.6439		51.5	156	132	7	6	78.7
		(Whole)	0.5488		70.5	850	140	5	6	44.0
Valley Creek at Confluence with Black Warrior (RM 0.2-0.5)	Bluecat	(Liver)	0.5305		22.0	550	87	19	2	5.8
		(Flesh)	0.3098		22.0	99	64	8	4	5.0
		(Liver)	0.0602		38.0	1,300	231	20	10	30.0
		(Flesh)	0.3659		24.0	58	98	2	<1	15.0
Valley Creek at Confluence with Black Warrior (RM 0.0-0.2)	Large Mouth Bass	(Flesh)	1.0746		33.3	116	71	9	2	3.6
		(Liver)	1.1026		20.3	400	45	9	3	4.3
		(Flesh)	1.2819		25.9	56	46	5	1	2.0
		(Liver)	1.2870		27.8	515	54	7	2	7.0
		(Flesh)	0.9364		39.7	98	51	6	3	3.0
	Bluegill	(Liver)	0.0949		4.0	1,110	155	18	9	20.0
		(Flesh)	0.2800		41.0	295	62	2	3	1.0
	Channel Catfish	(Liver)	0.7229		29.0	640	120	45	4	7.8
		(Flesh)	0.4773		17.6	212	49	16	4	3.0
	Bluegill	(Liver)	0.1111		15.0	1,140	193	20	30	30.0
		(Flesh)	0.3922		37.0	61	25	2	1	1.0
Black Warrior (RM 303)	Gar	(Liver)	0.9273		97.8	720	114	12	7	12.0
Village Creek at Confluence with Locust Fork (Black Warrior RM 405)	Green Sunfish	(Whole)	1.7272		28	270	123	9	8	82.2
		(Liver)	0.0405		<10	510	110	10	<10	7.0
		(Flesh)	0.6107		27	26	29	2	1	1.0
Village Creek at Confluence with Locust Fork (Black Warrior RM 403)	Bluegill	(Liver)	0.1505		8	442	146	12	3	18.0
		(Flesh)	0.5004		21	46	28	3	<1	3.0
		(Liver)	0.0315		<10	810	100	21	<13	20.0
		(Flesh)	0.4035		17	25	38	3	1	3.0
	Green Sunfish	(Liver)	0.0174		<20	1,200	90	12	24	60.0
		(Flesh)	0.3090		19	51	29	3	<1	3.0
		(Flesh)	1.0023		31.7	180	52	15	2	3.8
	Channel Catfish	(Liver)	0.6759		47.3	550	95	8	3	3.1
		(Liver)	0.7758		28.1	1,820	81	10	2	15.0
		(Flesh)	0.6023		26.6	59	78	34	10	4.0
		(Flesh)	0.7191		27.0	59	50	6	3	4.6
		(Liver)	0.5368		51.0	420	110	8	3	4.0
Black Creek*	Bass	(Flesh)	0.4532		6.4	410	54	38	2	2.0
		(Liver)	0.2529		8.1	1,100	131	55	5	8.0

*Received from area fishermen.

**Cd data deleted due to unresolved analytical error. Cd data developed during verification study is presented in Table 3-23.

TABLE 3-23

COMPARISON OF HEAVY METALS ANALYSIS OF FISH TISSUE - SECOND SURVEY

Species	Wt (Grams)	Age* (Yr)	Tissue Sampled	Cd (mg/kg Dry Wt)	Zn (mg/kg Dry Wt)
Micropterus salmoides	359	3	Muscle	0.40 (0.20)**	105 (44.57)
			Liver	0.86	73.3
			Kidney	5.50	85.5
Micropterus salmoides	235	2	Muscle	6.80 (0.30)	175 (46.26)
			Liver	1.20	81
Micropterus salmoides	66.5	0	Muscle	0.32 (0.53)	21.7 (33.27)
			Liver	2.50	96.3
Pomoxis anulams	133	1	Muscle	0.27 (0.47)	2.50 (26.54)
			Liver	1.00	66.30
Pomoxis anulams	121	1	Muscle	6.10 (0.13)	330 (25.82)
			Liver	4.10	86.6
Pomoxis anulams	90	1	Muscle	0.38 (0.75)	72.7 (27.11)
Lepomis macrochirus	64	3	Muscle	0.65 (0.20)	38.30 (20.44)
			Liver	4.30	114
Lepomis macrochirus	43	2	Muscle	0.90 (0.25)	40.4 (35.86)
			Liver	3.10	92.5
"	38	2	Muscle	0.75 (1.33)	52.40 (46.16)
			Liver	4.7	120
"	32	2	Muscle	0.72 (0.74)	24.70 (41.42)
			Liver	5.80	107
Ictalurus punctatus	83	--	Muscle	1.10 (0.38)	36.90 (27.27)
			Liver	6.20	97.70
	170	--	Liver	2.10 (2.04)	124 (108)

*Age - Determined using scale method

**( ) - Determined by Tennessee Technological University

Average Zn concentration for species collected during first survey:

Micropterus salmoides - Muscle - 56.00 mg/kg
Liver - 49.50 mg/kg

Lepomis macrochirus - Muscle - 43.40 mg/kg
Liver - 174.0 mg/kg

Ictalurus punctatus - Muscle - 70.33 mg/kg
Liver - 146.0 mg/kg

Wilhm and Dorris (1968) have found that values of $\overline{D}$ are usually less than one for areas of heavy pollution, from one to three in areas of moderate pollution, and greater than three in unpolluted water. The calculated diversity indices ($\overline{D}$) for each station were seldom greater than two and, consequently, are below the $\overline{D}$ accepted as indicative of a healthy stream and in fact fall into the stressed range. In addition to the numerical comparisons, the observation of large numbers of *Oligochaeta* and *Chironomidae taxa* indicates moderate pollutional stress (Table 3-24).

Periphyton. The health of the periphyton as indicated by the chlorophyll *a*, pheophyton *a* ratio falls into the "mixed" range. This indicates a population with both intact and viable cells as well as cells which are disrupted and decaying. Only two stations had populations where no decaying cells were observed. This is tempered by the fact that the population examined was a winter collection and no seasonal numbers are available for comparison. It is expected, however, that these streams exhibit a summer maximum and winter minimum. (Baseline periphyton data are presented in Table 3-25.)

Zooplankton. Zooplankton samples taken at the confluence of Valley Creek with Bankhead Reservoir and one mile above and one mile below the confluence indicate that relatively enriched zooplankton populations existed at the time of the seining (Table 3-26). Such populations are common for areas receiving moderate organic pollution.

Rare and Endangered Species. No rare or endangered species were collected or observed during the field survey efforts. A review of the publication "Rare and Endangered Vertebrates of Alabama" revealed that no known populations of rare and endangered vertebrates are listed for the specific study area.

Migratory Wildlife. The only wildlife of significance that use the Jefferson County, Alabama region as a migration route are waterfowl, songbirds, and birds of prey. Other than these groups, migratory patterns are not of consequence in studying wildlife habits.

TABLE 3-24

SUMMARY OF BASELINE BENTHIC MACROINVERTEBRATE TAXA

Class	Order	Family	Genus	Species	Opossum Creek Stations				Village Creek Stations						Valley Creek Stations										
					1	2	3	4	1	2	4	5	6	7	1	2	3	4	5	6	7	8	9	10	11
Nematoda	--	--	--	--	-	-	-	2	2	-	1	1	-	1	3	-	1	1	1	5	1	-	1	-	75
Oligochaeta	--	--	--	--		42	13	18	293	-	35	76	444	46	171	15	28	249	1300	545	309	56	1958	498	2914
Hirudinea	--	--	--	--	-	-	-	-	-	-	-	-	21	-	-	-	-	-	-	1	1	7	5	2	7
Crustacea	Isopoda	Asellidae	Asellus	--	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-
Crustacea	Amphipoda	Gammaridae	Crangonyx	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Crustacea	Decapoda	Astacidae	Cambarus	--	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Crustacea	Decapoda	Astacidae	Orconectes	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crustacea	Ostracoda	Astacidae	--	--	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Insecta	Collembola	Poduridae	Podura	aquatica	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Insecta	Plecoptera	Perlodidae	Isoperla	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Insecta	Odonata	Coenagriidae	Argia	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Insecta	Odonata	Coenagriidae	Coenagrion	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Insecta	Ephemeroptera	Baetidae	Baetis	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
Insecta	Ephemeroptera	Baetidae	Pseudocloeon	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Insecta	Ephemeroptera	Heptageniidae	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecta	Ephemeroptera	Heptageniidae	Stenonema	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsycae	--	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
Insecta	Lepidoptera	Pyralididae	Synclitus	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Insecta	Diptera	Culicidae	Chaeoborus	--	-	-	-	-	-	-	1	-	-	-	-	-	-	-	4	-	-	13	1	31	8
Insecta	Diptera	Tipulidae	Tipula	--	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	70	-	-	-
Insecta	Diptera	Ceratopogonidae	--	--	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	7	3
Insecta	Diptera	Chironomidae	--	--	-	3	4	6	5	-	1	1	9	4	40	-	5	6	370	78	21	619	122	89	203
Insecta	Diptera	Tobanidae	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecta	Diptera	Dolichopodidae	--	--	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Insecta	Diptera	Empididae	--	--	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-
Insecta	Coleoptera	Elmidae	Lara	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Insecta	Coleoptera	Elmidae	Dubiraphia	--	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecta	Coleoptera	Elmidae	Optioservus	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Archnida	Acarina	Unionicolidae	Unicnicola	--	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Gastropoda	Basommatophora	Physidae	Physa	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	39	-	47	-	-	-
Gastropoda	Basommatophora	Physidae	Physa	integra	-	1	-	-	-	-	-	1	1	-	-	-	-	-	6	6	-	1	1	-	-
Gastropoda	Basommatophora	Physidae	--		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastropoda	Mesogastropoda	Bithyniidae	Bithynia	tentaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Bivaluia	Heterodontida	Corbiculidae	Corbicula	manittensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	741	277	80
Bivaluia	Heterodontida	Sphaeriidae	Pisidium	--	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-	-	-	30	16	2
Number of Taxa Collected					1	4	4	3	4	1	6	4	6	4	5	1	4	3	9	7	4	15	10	8	12

TABLE 3-25

SUMMARY OF BASELINE PERIPHYTON DATA[a]

Phylum	Order	Family	Genus	Species	Variety	Opossum Creek Stations 1	2	3	4	Valley Creek Stations 1	2	3	4	5	6	7	8	9	10	11	Village Creek Stations 1	2	3	4	5	6	7
Chlorophyta	Tetrasporales	Tetrasporaceae	Tetraspora	--	--	-	-	-	-	-	-	-	-	-	-	-	-	TNTC	TNTC	2030	-	-	-	-	-	-	-
		Desmidioceae	Cosmarium	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chaetophorales	Chaetophoraceae	Stigeoclonium	tenue	--	-	-	-	-	-	-	-	-	-	-	-	-	TNTC	TNTC	TNTC	-	-	-	-	-	-	-
Euglenophyta	Euglenaceae	Euglena	--	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysophyta						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diatomaceae	Centrales	Cosinodiscaceae	Melosira	varians	--	-	-	-	1455	-	-	-	-	-	-	-	-	1273	319	1556	-	43	3	-	-	-	-
			Cyclotella	(menegheniana)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
	Pennales	Fragilariaceae	Astronella	formosa	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Diatoma	vulgara	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Fragilaria	crotonensis	--	-	2	-	152	-	-	-	-	-	-	-	32	43	60	22	-	-	-	148	-	-	-
			Fragilaria	(capucina)	--	-	-	-	-	-	-	-	-	-	-	-	27	-	-	-	-	-	-	-	-	-	-
			Meridion	circulare	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67	-	-	-	-	-	-	-
			Tabellaria	fenestrata	--	-	-	-	22	-	-	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Synedra	fasciculata	truncata	2	2	-	22	-	-	2356	-	18	9	-	40	36	59	45	-	4	15	2740	-	22	23
			Synedra	goulardii	fluveatilis	-	-	-	238	-	-	55	-	10	62	-	36	174	-	289	-	13	6	-	-	-	-
			Synedra	ulna	--	-	3	-	195	-	-	63	-	33	107	-	27	101	119	1711	-	76	6	-	-	-	14
			Synedra	cincisa	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Synedra	(cyclopum)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Achnanthaceae	Achnanthes	lancelota	--	2	4	-	2145	-	-	294	12	1044	1076	-	409	507	237	5933	-	13	38	667	-	333	783
			Achnanthes	houckiana	--	-	-	-	-	-	-	26	16	40	36	-	-	-	15	-	-	22	-	-	-	-	-
			Achnanthes	deflexia	lineata	1	2	-	-	-	-	28	-	-	-	-	45	76	-	156	-	-	3	148	-	-	27
			Cocconeis	placentula	--	-	-	-	-	-	-	55	-	13	-	-	5	-	-	-	-	-	-	-	-	-	-
		Eunotiaceae	Eunotia	meisteri	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Eunotia	denticula	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Eunotia	(perpusilla)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Navicula	Navicula	secreta	--	-	-	-	-	-	-	-	-	14	-	-	5	-	-	-	-	-	-	-	-	-	-
			Navicula	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-
			Caloneis	(species)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
			Gyrosigma	(attenuatum)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Pinnularia	hilseena	--	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-
			Pinnularia	braunii	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
			Pinnularia	caudlata	--	-	-	-	-	-	-	-	-	-	27	-	5	-	-	-	-	-	-	-	-	-	-
			Pinnularia	(species)	--	-	-	-	-	-	-	37	-	-	-	-	-	-	30	-	-	-	-	-	-	-	-
			Stauroneis	(kriegeri)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Stauroneis	abbreviatum	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	61
		Gomphonemaceae	Gomphonema	subclavatum	mexicanum	2	2	-	108	-	-	18	-	91	133	-	125	327	74	556	-	-	12	296	-	4823	614
			Gomphonema	parvulum	--	-	3	-	87	-	-	-	-	102	213	-	36	97	30	400	-	-	3	75	-	2578	260
			Gomphonema	arqur	--	-	-	-	-																		
		Cymbellaceae	Cymbella	affinis	--	-	-	-	-	-	-	-	-	-	-	-	-	-	74	-	-	4	6	-	-	-	-
			Cymbella	cistula	--	-	-	-	108	-	-	-	-	-	-	-	-	-	-	89	-	-	-	-	-	-	14
			Cymbella	(minuta)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
			Amphora	(veneta)	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Nitzchiaceae	Bacillaria	--	--	-	-	-	-																		
			Nitzchia	palea	--	1	5	-	22	-	-	76	-	115	89	-	-	30	115	67	-	9	27	1259	-	133	27
			Nitzchia	dissipatae	--	-	-	-	65	-	-	18	28	30	30	-	67	-	-	45	-	-	-	148	-	-	27
			Nitzchia	linearis	--	-	-	-	-	-	-	18	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Nitzchia	navicularis	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Nitzchia	tryblionella	--	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Nitzchia	(cuspidata)	--	-	-	-	-																		
			Nitzchia	sclaris	--	-	-	-	-																		
			Nitzchia	lancelota	--	8	1	-	216	-	-	-	8	-	9	-	-	-	22	-	-	-	-	-	-	-	-
			Nitzchia	sinuata	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Surrellaceae	Surirella	ovata	--	-	-	-	-	-	-	419	20	169	293	-	98	76	-	22	-	4	44	370	-	311	58
			Surirella	biseriata	--	3	-	-	-	-	-	55	8	22	71	-	27	38	-	22	-	-	24	74	-	22	27
Cyanophyta	Oscillatoriales	Oscillatoriaceae	Oscillotoria	--	--	-	-	-	-									-									
TOTAL SPECIES						15	17	-	16	-	-	23	14	18	16	-	122	19	15	25	-	9	16	17	-	13	14

() Most Probable Taxa
TNTC Too Numerous to Count

[a] number per mm^2 (arithmetic mean of 3 samples)

TABLE 3-26

ZOOPLANKTON COMPOSITION-BANKHEAD RESERVOIR

Zooplankton Taxa	Station No.* 1	2 (Frequency-%)	3
COPEPODA			
Cyclopoida			
Cyclops vernalis	3.4	11.0	7.0
Mesocyclops edax	3.4	12.0	7.1
Calanoida			
Diaptomus floridanus	10.6	14.6	10.1
Nauplii	13.1	29.8	55.6
CLADOCERA			
Bosmina sp.			
Bosmina coregoni	1.9	9.5	2.0
Bosmina longirostris	1.9	2.6	3.0
Daphinia ambigua	3.3	5.4	4.3
Daphnosoma leuchtenberganum	.32	.53	.28
Alona sp.	.08	-	-
ROTIFERA			
Asplanchna sp.	5.2	8.7	2.6
Brachionus calyciflorus	19.6	6.6	2.6
Brachionus angularis	.08	-	-
Keratella cochlearis	.08	.26	.28
Platius patulus	.08	-	-
Philodinia sp.	-	.08	.28
Polyarthra vulgaris	.24	.08	.86
Synchaeta sp.	36.5	4.8	3.8

*1 - At Confluence with Valley Creek
2 - One mile downstream of Confluence with Valley Creek
3 - One mile upstream of Confluence with Valley Creek

Alabama is on the Eastern fringe of the Mississippi Flyway System. There is some overlapping of species from the Atlantic Flyway that wander into the area.

The wood duck (Aix sponse) is the only "native" Alabama species of waterfowl which breeds through the State in significant numbers. Summer brood surveys show that about 50,000 young wood ducks are produced annually in the State. Wood ducks were on the verge of extinction in the early 1900's. Overharvesting, loss of habitat through draining of the swamps and marshes and removal of trees that provided nesting cavities had taken a heavy toll of the species. The Game and Fish Division of the Alabama Department of Conservation and Natural Resources has been instrumental in research and management activities that have brought the wood duck from its low ebb to a substantial population.

In Jefferson County and the Black Warrior River Basin, a great variety of habitats exists which is conducive to many species of migratory birds. The major limiting factor is food; however, waterfowl prefer agricultural fringe areas where food such as small grains, corn, soybeans, and a variety of forage species (grasses) are available. Migratory waterfowl are unable to find adequate food of these kinds in Jefferson County for subsistance through the winter. Adequate cover and water are available; however, waterfowl populations are rather low. Songbirds find the area more to their liking. The marshes, river, creeks, swamps, forest, and fringe areas provide excellent wintering grounds for this group. Many species over winter in the area or use it for a temporary stopover while migrating farther southward.

Birds of prey typically follow waterfowl and songbirds in their migration routes. Those species and individuals that prey upon waterfowl are to be found in lesser numbers than those that prey upon songbirds. As a result, birds of prey will be concentrated according to their favorite prey.

Birds in the study area were included in the biological survey by observation at all stations during sampling periods and during canoe travels down the streams. Those birds observed in the area by AWARE, Inc. are shown in Appendix B-3 of the Technical Support Document. In addition to field observations, library research has produced a taxonomic list of birds of the Black Warrior River Basin which is also included in Appendix B-3.

Amphibians, and Reptiles. Cursory observations by AWARE, Inc. during the field survey recorded ten species of reptiles and amphibians in the study area. These are the Eastern Cottonmouth, Canebreak Rattle Snake, three water snakes, common snapping turtle, alligator snapping turtle, Eastern Painted turtle, Alabama Map turtle, and the Eastern Chicken turtle.

Mammals. The majority of the mammal data was compiled from on-site observations. Relative indices of abundance were established from actual sightings, droppings, tracks, den and nest sites, conversations with local residents, and information from the Alabama Department of Conservation. Stream banks and game trails were examined for spoor and other indicators. Photographs were taken of appropriate signs of wildlife in the study areas. Details are included in the Technical Support Document concerning mammal abundance indicators for beaver, raccoon, gray squirrel, opossum, striped skunk, eastern cottontail, whitetail deer, muskrat, and mink.

3.1.10.1. Terrestrial Vegetation

The proposed plant site is not considered a biologically sensitive area. No unusual or rare species exist on the site. No uniquely large trees will be affected. There is no official list of rare or endangered plant species for Alabama, however, the Department of Conservation is currently developing such a list. The Forestry Commission has, however, become concerned with the status of the ginseng plant. Due to high market values of the roots of this plant, there is concern that individuals will seek to collect this for market purposes.

The Warrior River Basin and its tributary system contain approximately 30 families of trees and woody shrubs. Some areas along some of the streams are unusual in the diversity of vegetation. A partial list of the dominant plant species occurring in the mixed riparian zones is presented in Appendix B-6 of the Technical Support Document.

Although there are marked differences in early sere stages, later ones tend to become more alike, so that eventually convergence occurs. Seres pass through several stages in this area, therefore, the climax communities of all seres are much alike regardless of their origin.

Riparian wetlands and transition zones predominate vegetation from on-site observations consisted primarily of:

Black Willow *Salix nigra*
American Sycamore *Plantanus occidentalis*
Red Maple *Acer rubrum*
Box Elder *Acer negundo*
Ironwood *Carpinus carolmiana*
Yellow Poplar *Liriodendron tulipifera*
Sweet Gum *Lignidambar styraciflua*
Loblolly Pine *Pinus taeda*
American Beech *Fagus grandifolia*
Sassafras *Sassafras alibidum*
White Ash *Fraxinum americana*
American Elm *Ulmus americana*
Mountain Laurel *Kalmia latifolia*
River Cane *Arnndinaria gigantea*
Privet *Ligustrum sinense*
Honeysuckle *Lonicera simpervirens*
Elderberry *Sambucus canadensis*
Various forbs, grasses, and sedges

3.1.11. Land Use

Existing. Jefferson County in its early years followed the pattern of most new frontiers in development. That pattern is for new settlers to locate in the river valleys where there are sources of water for personal and industrial uses. Also, transportation routes in the early years followed and used the rivers and river valleys. Consequently, industrial areas were developed on sites that were topographically desirable, being level to only slightly rolling. Residential developments were then located surrounding the industrial areas. As time went on, these developments continued in generally a diagonally southwest-northeast pattern. This pattern primarily is in the Jones and Opossum Valleys (Figure 3-24).

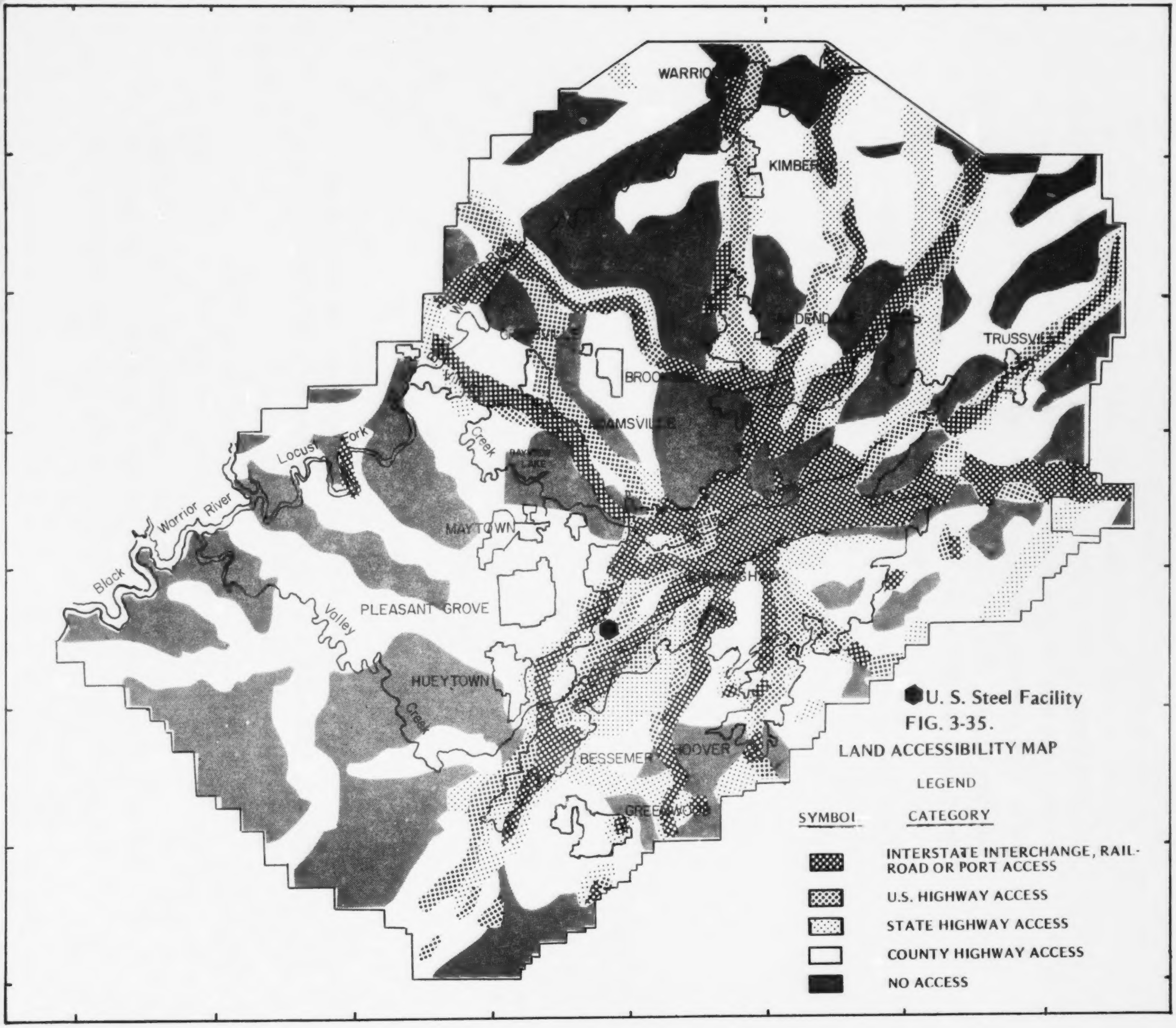
As the Birmingham area grew, there began outward, urban residential expansion from Jones and Opossum Valleys. This expansion crossed Red Mountain and has spread into Shades Valley. Continued growth has occurred along the major transportation corridors into Shelby County. Also, expansion has occurred in the northern part of the county. These growth patterns have generally followed highways U. S. 31 and Alabama highways 75 and 70 (Figure 3-35).

Opossum Valley has been and is the center for industrial development in Jefferson County. There are also pressures for industrial land use occurring in Shades Valley and Pinson Valley.

Commercial land use is basically located in the Central Business District in downtown Birmingham. However, major shopping centers have located in many of the suburbs. Additional strip development commercial concerns have occurred along major arterial streets.

The downtown Birmingham area, due to its topography and soil types, in reality is the most suitable area for agriculture in Jefferson County. However, early farmers were forced out of these more sutiable areas to make room for industrial, residential, and commercial concerns. Agricultural enterprises are now located in the northern and northwestern parts of the county.

Surface extraction of minerals is scattered throughout the county, but primary mining is in the northern and western sections.



WARRIO
KIMBER
TRUSSVILLE
BROO
AMSVILLE
BAYVIEW LAKE
MAYTOWN
PLEASANT GROVE
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
Black Warrior River
Locust Fork
Valley Creek
Creek

● U. S. Steel Facility

FIG. 3-35.
LAND ACCESSIBILITY MAP

LEGEND

SYMBOL	CATEGORY
▩	INTERSTATE INTERCHANGE, RAILROAD OR PORT ACCESS
▦	U.S. HIGHWAY ACCESS
▨	STATE HIGHWAY ACCESS
☐	COUNTY HIGHWAY ACCESS
■	NO ACCESS

3.1.11.1. Land Suitability Plan

Jefferson County is now faced with tremendous development pressures. These pressures, similar to those in other urbanizing areas of the country, are expected to continue at least through the end of this century. Jefferson County has become more urbanized as time has passed. This has created a special need for the most feasible use of land for future development.

In order to proceed in a practical manner in this land allocation, it is first necessary to inventory the land itself. Potentials for development must consider the base physical characteristics. The physical characteristics of the land to be considered are:

1. Topography
2. Climate
3. Slope
4. Flood-Prone Areas
5. Soils
6. Geology
7. Mineral Resources

Other important factors that have a bearing on land suitability are:

1. Public Water Coverage
2. Public Sewage Coverage
3. Transportation Routes
4. Large Landholders
5. Existing Land Use

Based upon these characteristics, the Birmingham Regional Planning Commission has developed a "Land Suitability Plan." This plan is portrayed in Figure 3-36.

3.1.11.2. Large Landholders

Private corporations constitute the major landholders within Jefferson County. Over one-third (36.2 percent) of the total land area is owned by six private corporations. The largest portion

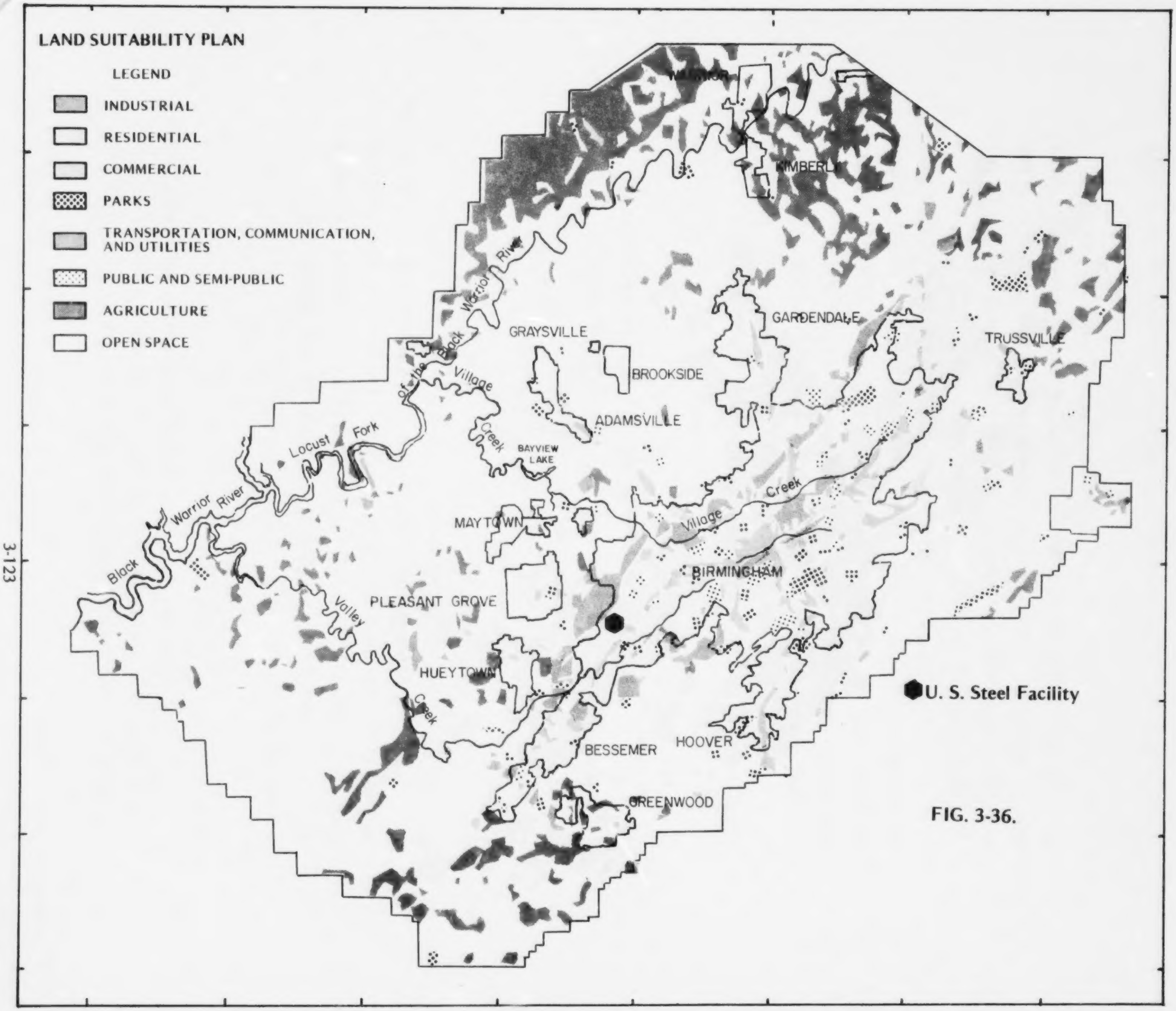

LAND SUITABILITY PLAN
LEGEND
INDUSTRIAL
RESIDENTIAL
COMMERCIAL
PARKS
TRANSPORTATION, COMMUNICATION, AND UTILITIES
PUBLIC AND SEMI-PUBLIC
AGRICULTURE
OPEN SPACE
WARRIOR
KIMBERLY
Black Warrior River
Locust Fork of the Black Warrior River
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
GARDENDALE
TRUSSVILLE
Village Creek
BAYVIEW LAKE
MAYTOWN
BIRMINGHAM
PLEASANT GROVE
Valley Creek
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
U. S. Steel Facility

FIG. 3-36.

of this land is in the northern and western portions of the county (Figure 3-37).

Zoning regulations, land use ordinances, and subdivision regulations are all regulatory implements used by federal, state, and local governments to determine land use patterns. Land use policies direct and regulate future growth, provided these policies are enforced by appropriate jurisdictions.

Should part of these land holdings be released for development, these will more than likely be released in very large parcels, such as the Oxmoor Industrial Development by U. S. Steel. When these large parcels are developed, they probably will be developed as large planned industrial or residential unit developments or a combination of the two. Obviously, these forms will contribute substantially to the continued growth of Jefferson County.

3.1.11.3. Residential Land

Residential acreage demands must be determined by accurate assessment of many factors. Among these are:

1. The projected population
2. Size of households
3. Housing density
4. Existing housing
5. Traffic zones

There is some overlapping in suitability of residential and industrial/commercial lands, however, residential land requirements are generally less stringent than those for industrial/commercial. Residentially suitable areas in Jefferson County are presented in Figure 3-38.

3.1.11.4. Agriculture Land

Existing land use, topography, soils, and transportation routes are important factors that affect agricultural land use suitability. Only approximately 29,600 acres are in agriculture.

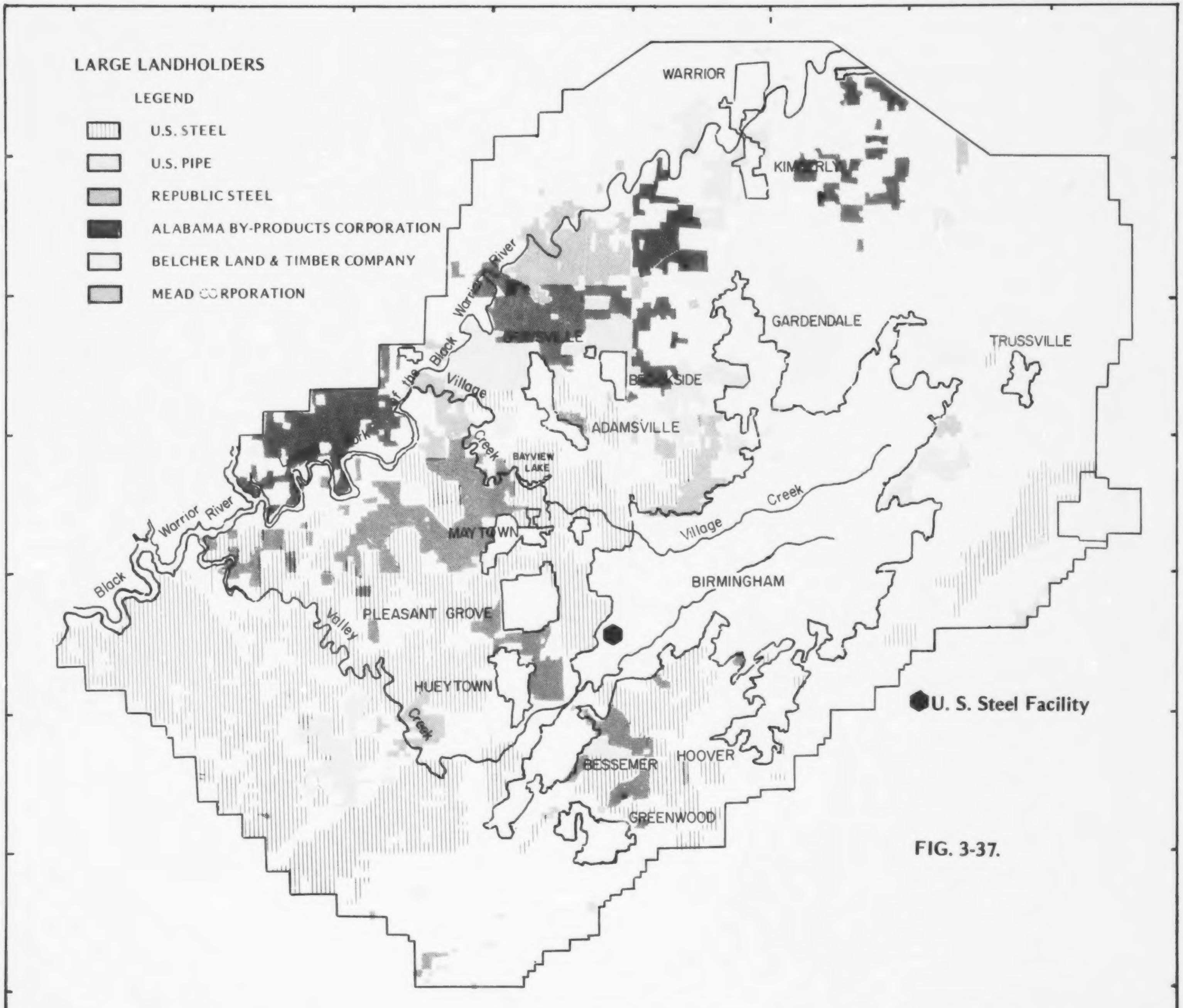

LARGE LANDHOLDERS
LEGEND
U.S. STEEL
U.S. PIPE
REPUBLIC STEEL
ALABAMA BY-PRODUCTS CORPORATION
BELCHER LAND & TIMBER COMPANY
MEAD CORPORATION
WARRIOR
KIMBERLY
GARDENDALE
TRUSSVILLE
Black Warrior River
Locust Fork of the Black Warrior River
Village Creek
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
MAYTOWN
BIRMINGHAM
PLEASANT GROVE
Valley Creek
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
U. S. Steel Facility

FIG. 3-37.

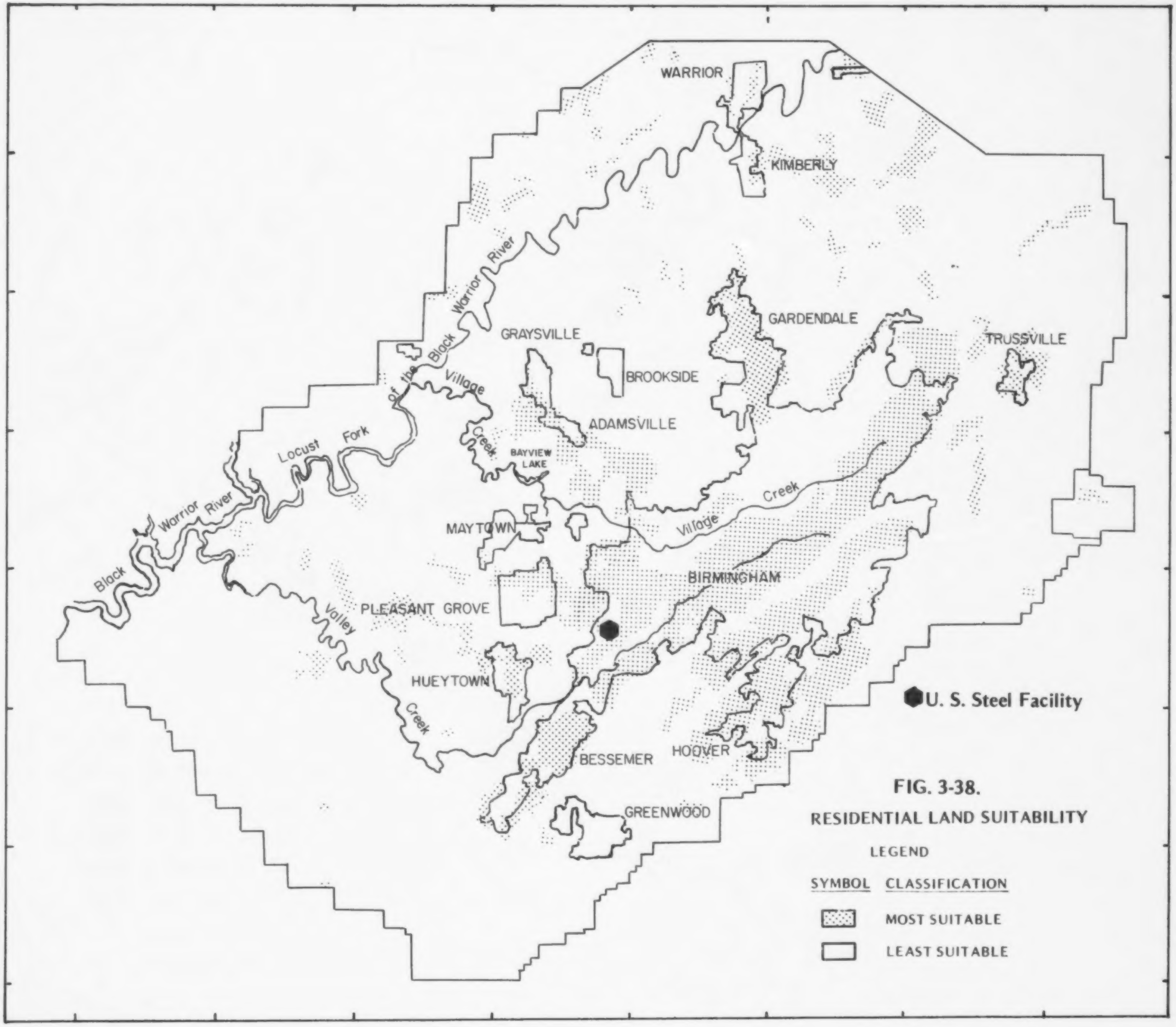

WARRIOR
KIMBERLY
GARDENDALE
TRUSSVILLE
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
MAYTOWN
BIRMINGHAM
PLEASANT GROVE
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
Black Warrior River
Locust Fork of the Black Warrior River
Village Creek
Valley Creek
U. S. Steel Facility
LEGEND
SYMBOL CLASSIFICATION
MOST SUITABLE
LEAST SUITABLE

FIG. 3-38.
RESIDENTIAL LAND SUITABILITY

This represents 0.5 percent of total land area in the county. Federal non-crop land accounts for 500 acres, crop land 14,900 acres, and pasture 14,200 acres. Agriculture land suitability maps are presented in Figure 3-39.

3.1.11.5. Extractive Land

The lands most suitable for extractive use are, of course, those that are underlain by a high priority economic mineral and not contiguous to existing incompatible land uses, such as residential. Coal is the most important mineral mined in Jefferson County from an economic priority standpoint.

Primary mineral resources and their locations are shown in Figure 3-40.

Coal. The Warrior coal field in the northern and western parts of the county, and the Cahaba coal field, in the southeastern part near Shelby County, are major coal resources.

Limestone. Widely distributed

Dolomite. Widely distributed

Chert. Widely distributed

Sand and Gravel. Scattered localities

Clay and Shale. Unlimited quantities

Iron Ore. Widely distributed

3.1.11.6. Recreational Land

The "Land Suitability Plan" formulated by the BRPC distributed recreational acreage which considered existing service areas and immediate demand as well as projected future needs. The plan can only identify areas suitable for open space/recreation uses. The type of recreational activity directly influences the amount and kind of land needed. A large portion of the county is conducive to open space/recreation (Figure 3-41).

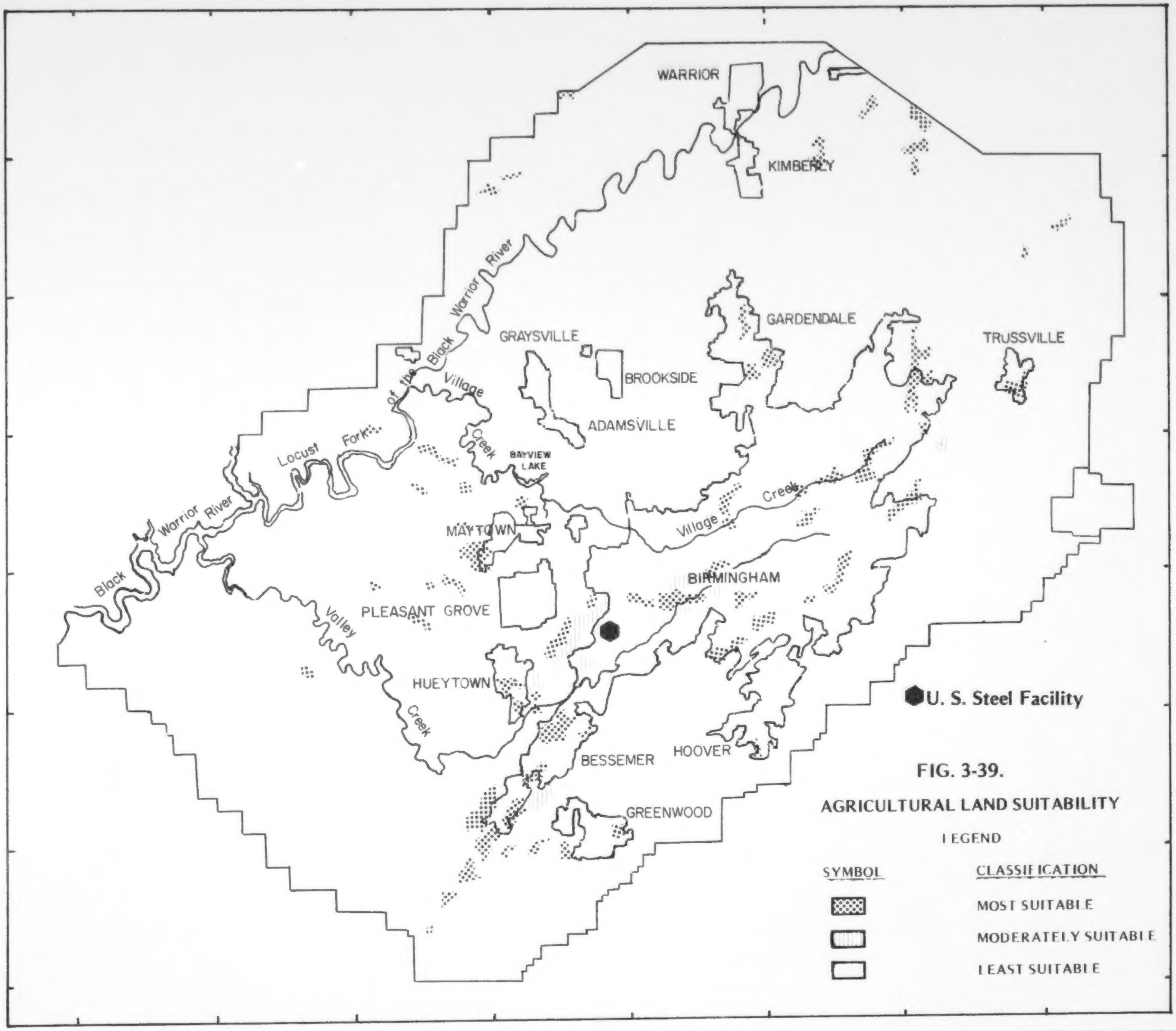
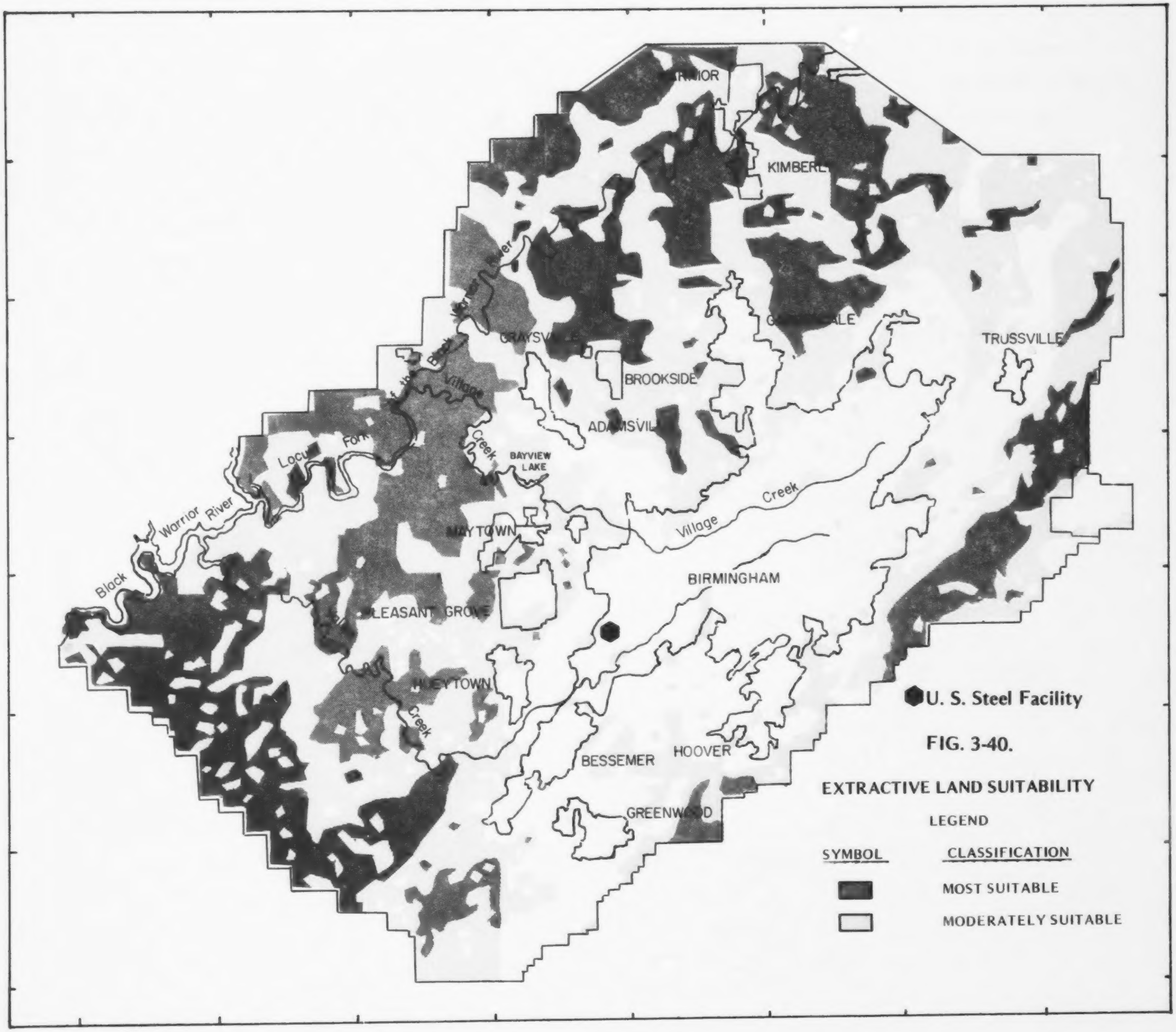

WARRIOR
KIMBERLY
Black Warrior River
Locust Fork of the Black Warrior River
GRAYSVILLE
BROOKSIDE
GARDENDALE
TRUSSVILLE
ADAMSVILLE
Village Creek
BAYVIEW LAKE
MAYTOWN
BIRMINGHAM
PLEASANT GROVE
Valley Creek
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
● U. S. Steel Facility
LEGEND
SYMBOL
CLASSIFICATION
▩ MOST SUITABLE
▥ MODERATELY SUITABLE
☐ LEAST SUITABLE

FIG. 3-39.

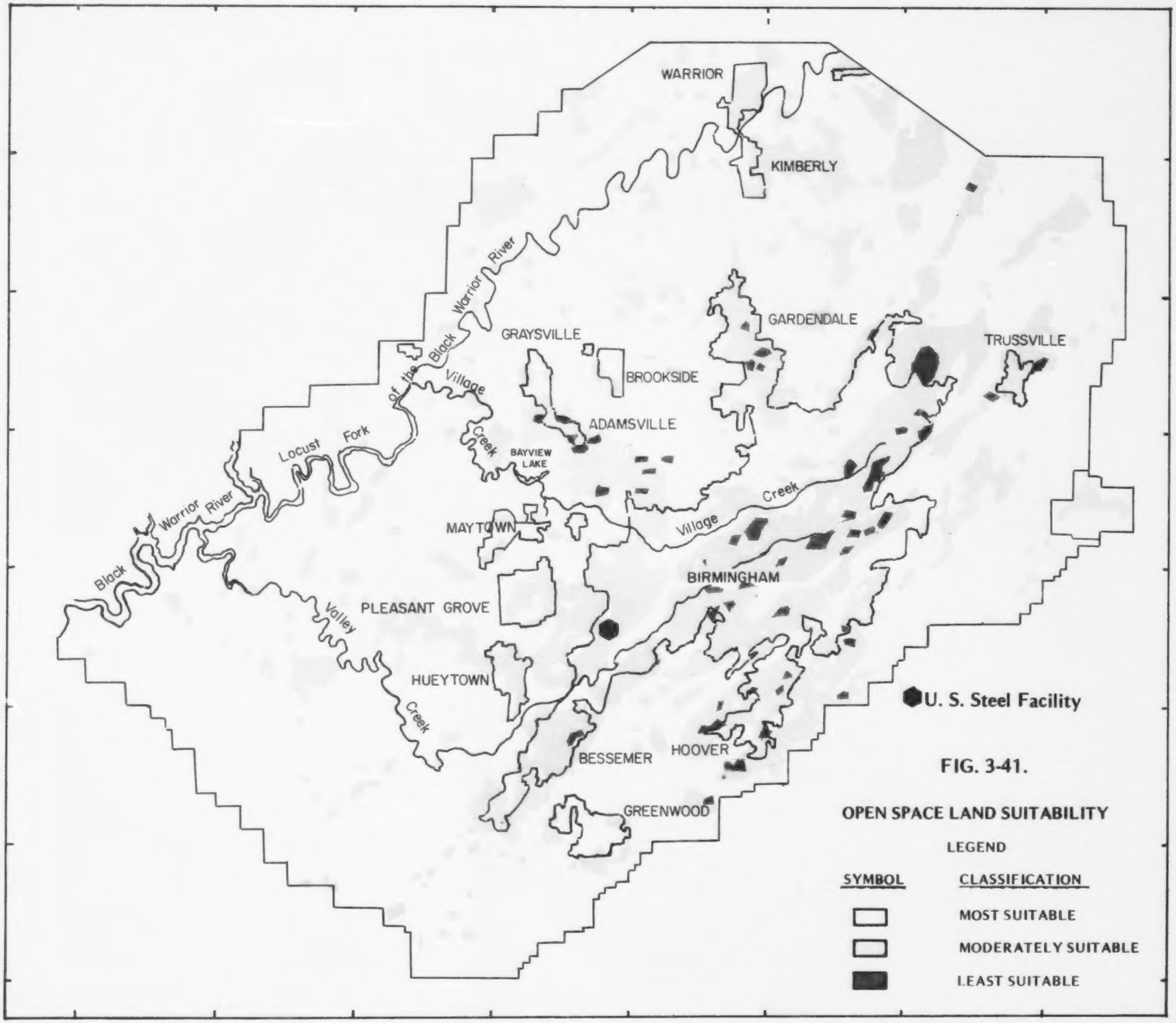
AGRICULTURAL LAND SUITABILITY



WARRIOR
KIMBERLY
GARDENDALE
TRUSSVILLE
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
Village Creek
MAYTOWN
BIRMINGHAM
Black Warrior River
Locust Fork
PLEASANT GROVE
HUEYTOWN
Creek
BESSEMER
HOOVER
GREENWOOD
● U. S. Steel Facility
LEGEND
SYMBOL
CLASSIFICATION
▨ MOST SUITABLE
☐ MODERATELY SUITABLE

FIG. 3-40.

EXTRACTIVE LAND SUITABILITY


WARRIOR
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Black Warrior River
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Locust Fork of the Black Warrior River
Black Warrior River
MAYTOWN
Village Creek
BIRMINGHAM
PLEASANT GROVE
Valley Creek
HUEYTOWN
BESSEMER
HOOVER
GREENWOOD
U. S. Steel Facility
LEGEND
SYMBOL
CLASSIFICATION
MOST SUITABLE
MODERATELY SUITABLE
LEAST SUITABLE

FIG. 3-41.

OPEN SPACE LAND SUITABILITY

3.1.11.7. Industrial Land

Industrial acreage requirements depend on the kinds of manufacturing activities that characterize the economy. In a land suitability plan, industrial land use should be the first distributed. This use requires lands that meet the most stringent criteria. Also, urban growth is better stimulated in distributing land use beginning with industrial then residential, commercial, recreational, etc. Geographic industrial and/or commercial land suitability is portrayed in Figure 3-42.

3.1.11.8. Transportation Systems

The Jefferson County area land use plans and patterns are enhanced by adequate transportation systems.

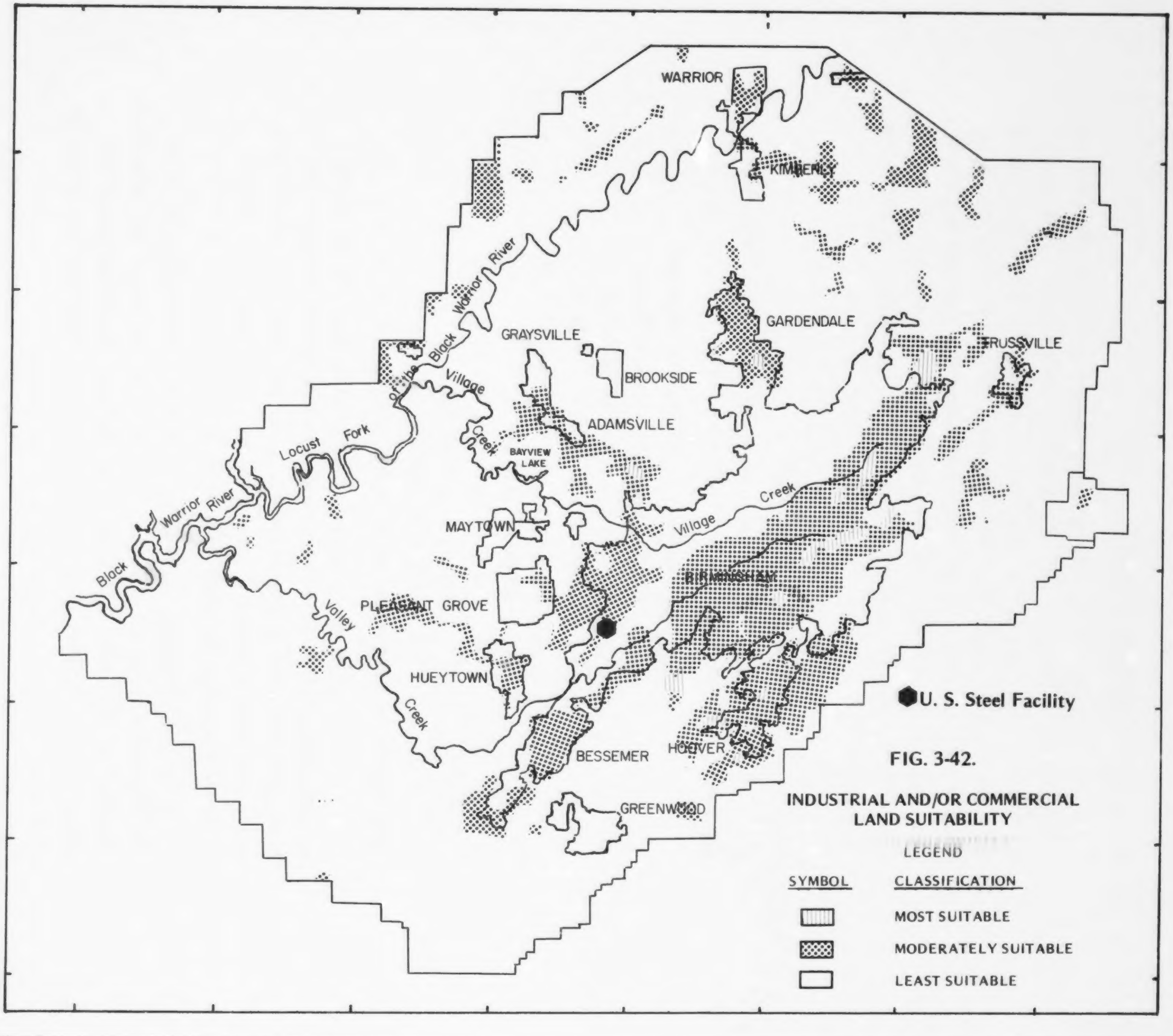
Railroads. Railroads serving the area are:

1. Alabama Great Southern Railroad
2. Gulf Mobile and Ohio Railroad
3. Louisville and Nashville Railroad
4. St. Louis-San Francisco Railroad
5. Southern Railway
6. The Seaboard Coast Line Railroad
7. Illinois Central Railway
8. Birmingham Southern Railroad

Both freight and passenger service are provided in the area.

Roads and Freeways. Major state and federal highway systems adequately provide for tourist, commercial and industrial traffic in the area. Interstate 65, U. S. 231, and U. S. 43 serve as the north-south linkages. Interstate 59, U. S. 278, U. S. 78 and U. S. 82 are the major east-west arteries.

Airports. The Birmingham Municipal Airport provides the major air transportation services for both passenger and commercial freight for the area. The airport is equipped to accommodate almost every type of aircraft now in service. Future expansion of facilities is expected.



WARRIOR
KIMBERLY
GARDENDALE
TRUSSVILLE
GRAYSVILLE
BROOKSIDE
ADAMSVILLE
BAYVIEW LAKE
MAYTOWN
PLEASANT GROVE
HUEYTOWN
BIRMINGHAM
BESSEMER
HOOVER
GREENWOOD
Black Warrior River
Locust Fork of the Black Warrior River
Village Creek
Valley Creek
U. S. Steel Facility
LEGEND
SYMBOL
CLASSIFICATION
MOST SUITABLE
MODERATELY SUITABLE
LEAST SUITABLE

FIG. 3-42.

INDUSTRIAL AND/OR COMMERCIAL LAND SUITABILITY

Water Routes. The Black Warrior-Tombigbee Waterway provides great positive impact on land use plans and development in the area. Port Birmingham provided a major terminal for raw materials and cargo shipment flows in the area. The Waterway is a major factor in commercial traffic.

3.1.12. Socio-Economic Conditions

3.1.12.1. Employment Analysis

History and Trends. A critical factor in the economic health of an area is employment activity. Comparisons of employment, between two given points in time, will indicate general economic growth. Two related categories that will influence the Birmingham region economically are:

1. National growth trends in employment by sector, and
2. Growth trends in non-manufacturing activity.

Incentives to the economic growth of the region offered by the Birmingham area are: adequate utilities, shipping and transportation routes, power and fuels, labor supply, and supportive and social services. Certainly, there are situations in the region that are negative. Recent labor disputes, limited sites, and decadent urban areas tend to restrain growth. However, the overall environment is conducive to positive growth.

It is expected that slight decreases will occur in agriculture and mining. Construction, transportation and communications, and certain aspects of the financial sector will remain relatively stable in percent of employment share, but will increase slightly in overall numbers. Some absolute increases are expected to occur in manufacturing, trade, service and government employment; however, a precarious balance exists in these sectors. Any major decline in expected expansion in any of these areas could result in increased unemployment.

3.1.12.2. The Regional Economy

Basic trends in economic activity and population growth in the Birmingham area have been influenced by the region's historical development and progress. The early years were influenced by the metal processing industries. Therefore, the early economy and its attendant life-styles have carried over into the present time, still substantially dependent upon steel production and its related activities.

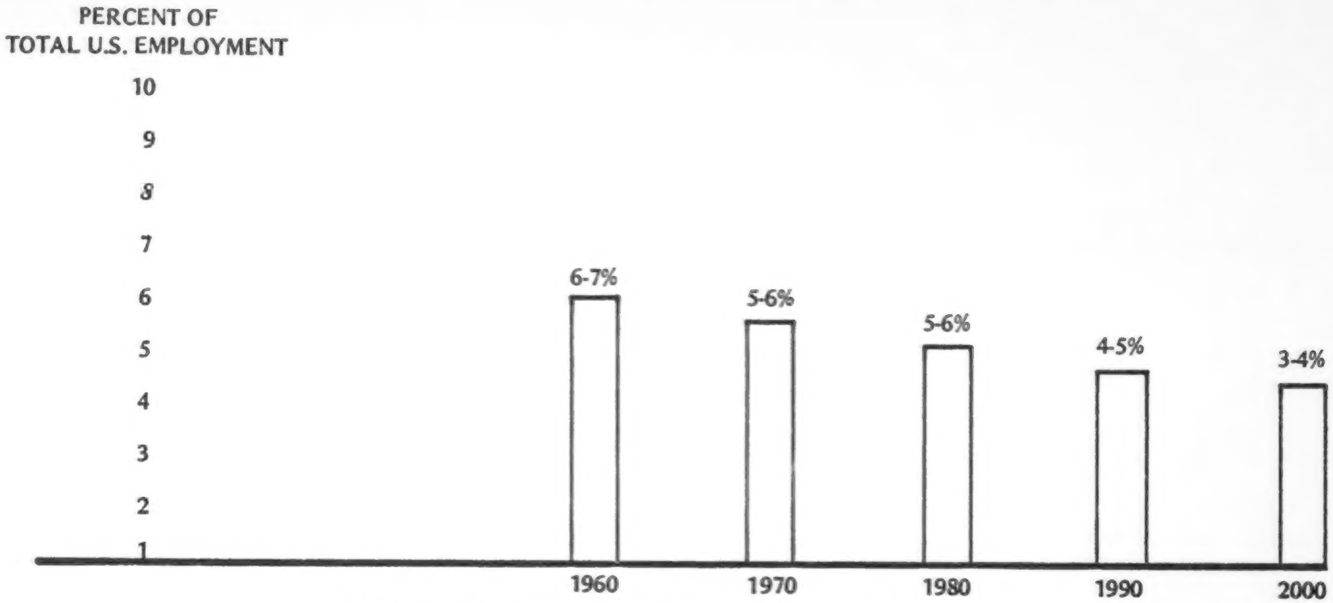
The major foundation of Birmingham's economy is its dependency on extractive industries and directly related activities. Investments in production facilities have resulted in an increase in the skilled and managerial labor force, however future growth will depend more heavily upon the area's public and private institutions. The public and private sectors will focus attention which will broaden and diversify the economic base.

Birmingham's metals facilities have historically provided a significant portion of southern steel production. In 1920, 86 percent of southern steel production was produced in Birmingham. In 1940, Birmingham produced 77 percent of southern steel. From 1940 to 1970, steel production in Birmingham has remained fairly stable, however, total steel output in the United States has increased. This has resulted in Birmingham's decrease in the percentage share produced nationwide (see Table 3-27). Nationwide, steel capacity increased less than 10 percent between 1960 and 1975.

Southeast Region and Birmingham Economic Growth. Other influences on Birmingham's future growth are comparative growth factors of other areas in the Southeast. Growth factors such as employment, population, and income reflect that the Southeast is one of the fastest growing regions in the nation, however, Birmingham's growth rate has been quite low, comparatively. Birmingham reflected lower growth indications than any region in the Southeast and even ran behind the United States average in population, manufacturing employment and personal income for the 15-year period from 1960 to 1975 (see Table 3-28).

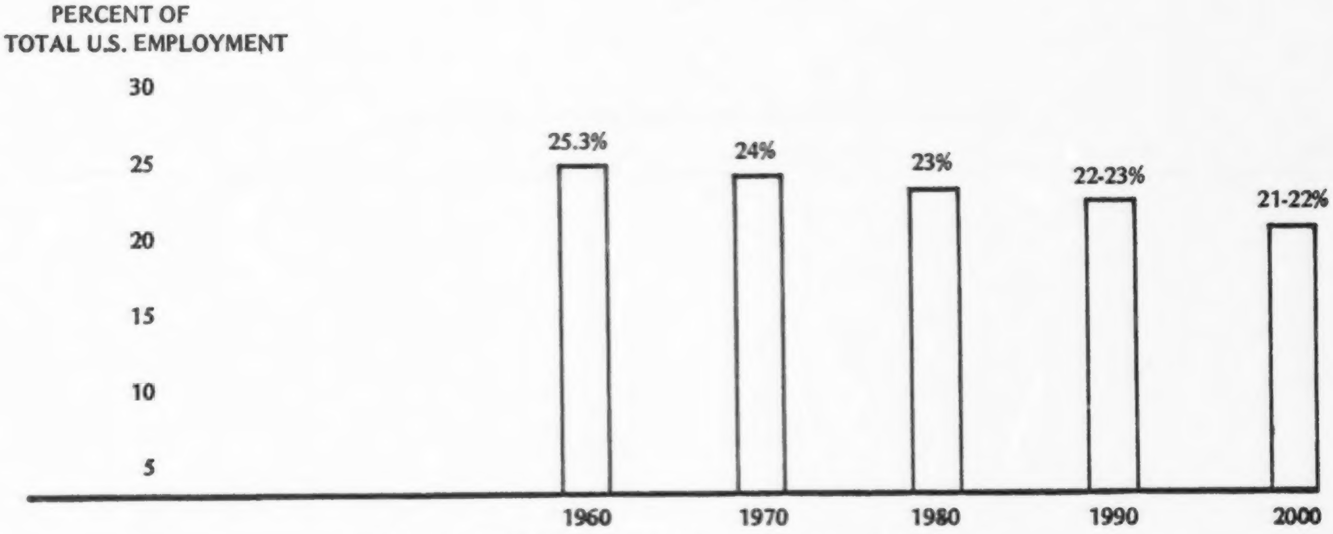
TABLE 3-27

MINING AND AGRICULTURE EMPLOYMENT TRENDS



SOURCE: BIRMINGHAM REGIONAL PLANNING COMMISSION

TABLE 3-28
MANUFACTURING EMPLOYMENT TRENDS



SOURCE: BIRMINGHAM REGIONAL PLANNING COMMISSION

Growth factors between 1970 and 1975 show that Birmingham is beginning to increase. This is a promising trend. In the mid-sixties, the adverse racial situation and steel industry cut backs retarded upward growth. Present trends reflect that Birmingham can now participate more in regional and national growth patterns.

The economy of the Birmingham area appears healthier than it was 15 or 20 years ago. Diversification is growing rapidly. There has been a decline in manufacturing and primary metals employment and an increase in government and services employment (see Tables 3-29 and 3-30). The decline in employment in metals produces the adverse effect of lowering personal and per capita income.

3.1.12.3. Demographic and Economic Considerations

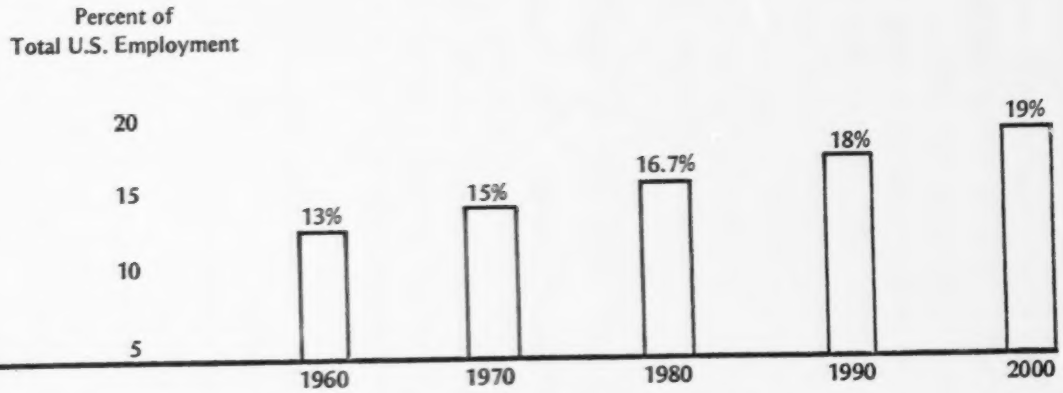
Analysis of Change. Population characteristics, population structure and population estimations are prime indicators of the economic health of a given region. The trends in population for the Birmingham area reflect a steady continuous growth since the 1950's. There are, however, changes that have occurred within the population.

In the fifties, Birmingham experienced a period of significant growth in population. This was due to a number of reasons; increased employment opportunities by the primary metals sector, rural to urban migrations, northern cities out-migration, and increased availability of welfare services and utilities.

In the sixties, however, Jefferson County experienced a slower population growth. Several reasons are advanced for this stability in employment in the primary metals sector; out-migration of workers to northern cities, competition from other southern cities (such as Atlanta), racial tension, moves to suburbs and antiquated structure of the city.

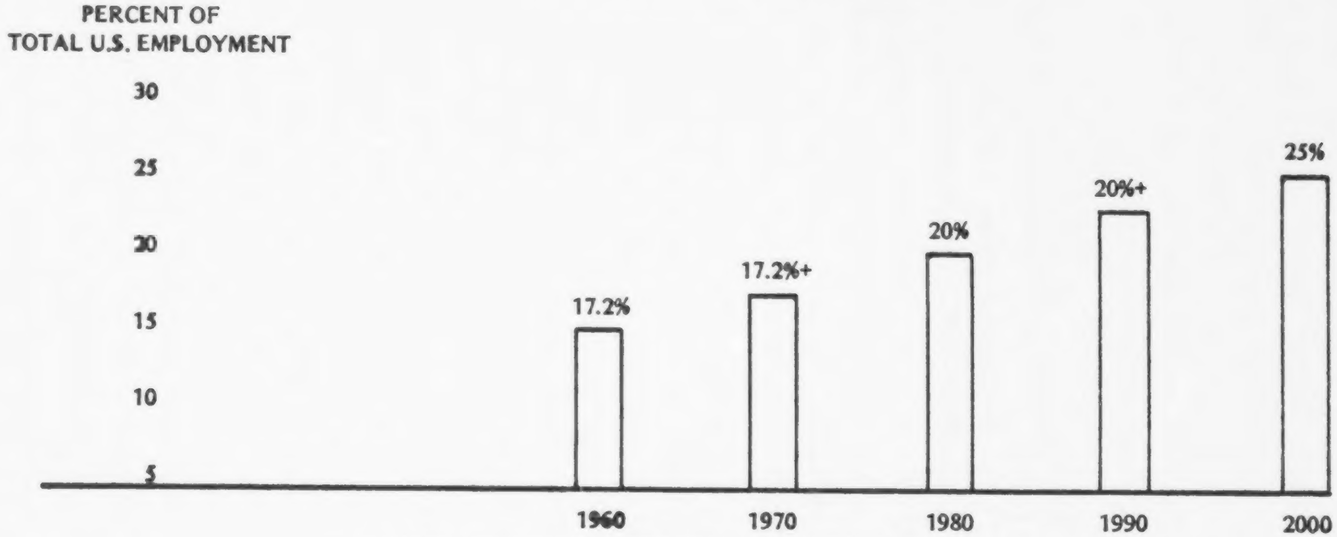
The 1970's should show a period of continued dispersal of urban populations to the suburbs, increased in-migration, decreasing natural population rates and increased overall regional growth.

TABLE 3-29
GOVERNMENT EMPLOYMENT TRENDS



Source: Birmingham Regional Planning Commission

TABLE 3-30
SERVICES EMPLOYMENT TRENDS



SOURCE: BIRMINGHAM REGIONAL PLANNING COMMISSION

The population for the Birmingham region shows a gradual overall increase for the period 1960 through 1975. In 1960, the population was 634,898. In 1975 it has increased to 649,500, a net increase of almost 15,000. There was a large out-migration during this period, however a substantial natural increase (births vs. deaths) reflected an overall net increase.

3.1.13. Cultural (Archeological, Historical, Architectural)

The Alabama Historical Commission has developed a number of programs which are aimed toward preservation, including surveys, planning, promotion, speaking engagements, and actual preservation projects. These programs are carried out in cooperation with federal agencies, local governmental and preservational groups, and other state agencies whenever possible.

Survey. The first major objective of the Commission was to inventory and catalogue all of Alabama's significant sites and structures and thus to determine which merit preservation and the order of restoration priorities. A preliminary listing of historic properties has been compiled for each county. This list serves as the basis for county-by-county in-depth surveys being made by staff members and local volunteers. More than 3,000 historic structures and sites have been located in the preliminary surveys and additional properties are added on a continuing basis.

Among the types of properties being surveyed are antebellum mansions, rustic structures such as log cabins, churches and covered bridges, old public buildings such as courthouses, city halls, railway depots, post offices, iron and stone bridges, and jails, and historic commercial and industrial buildings. In short, anything which is representative of a way of life and is at least 50 years old is eligible to be placed on the survey listing.

National Register. Properties which the Commission considers to be of lasting significance and worthy of preservation are nominated to the prestigious National Register of Historic Places kept by the Office of Archaeology and Historic Preservation, U. S. Department of the Interior. Once on the Register, these structures and sites are eligible for federal restoration funds and are protected from demolition by federally-financed projects, such as highway construction or urban renewal.

There are now 151 properites listed on the National Register and of these, 135 are individual nominations and 16 are historic districts which protect a total of 671 structures. As of 1974, there are 806 structures and sites included in the National Register from Alabama. A detailed list of these structures and sites is presented in the Technical Support Document.

3.1.14. Environmentally Sensitive Areas

Generally, the riparian wetlands have been relatively intolerant to man's activities in the upper reaches of the watersheds in the study areas. In other words, areas close to Birmingham reflect less diversity in both flora and fauna than those areas downstream contiguous to Bankhead Reservoir.

These upper reaches are unable to assimilate the excessive amounts of wastes received from the Birmingham industrial area. Therefore, no unique sensitive areas exist in the upper stretches adjacent to the streams.

No man-made sensitive areas--archeological, historical, cultural or recreational sites--exist adjacent to the streams in the study area that are influenced by stream pollution.

Essentially, three primary types of vegetative cover exist in Jefferson County, Alabama. These are:

1. Marsh
2. Riparian Wetlands
3. Upland Forests

Figure 3-43 shows the general locations of these types.

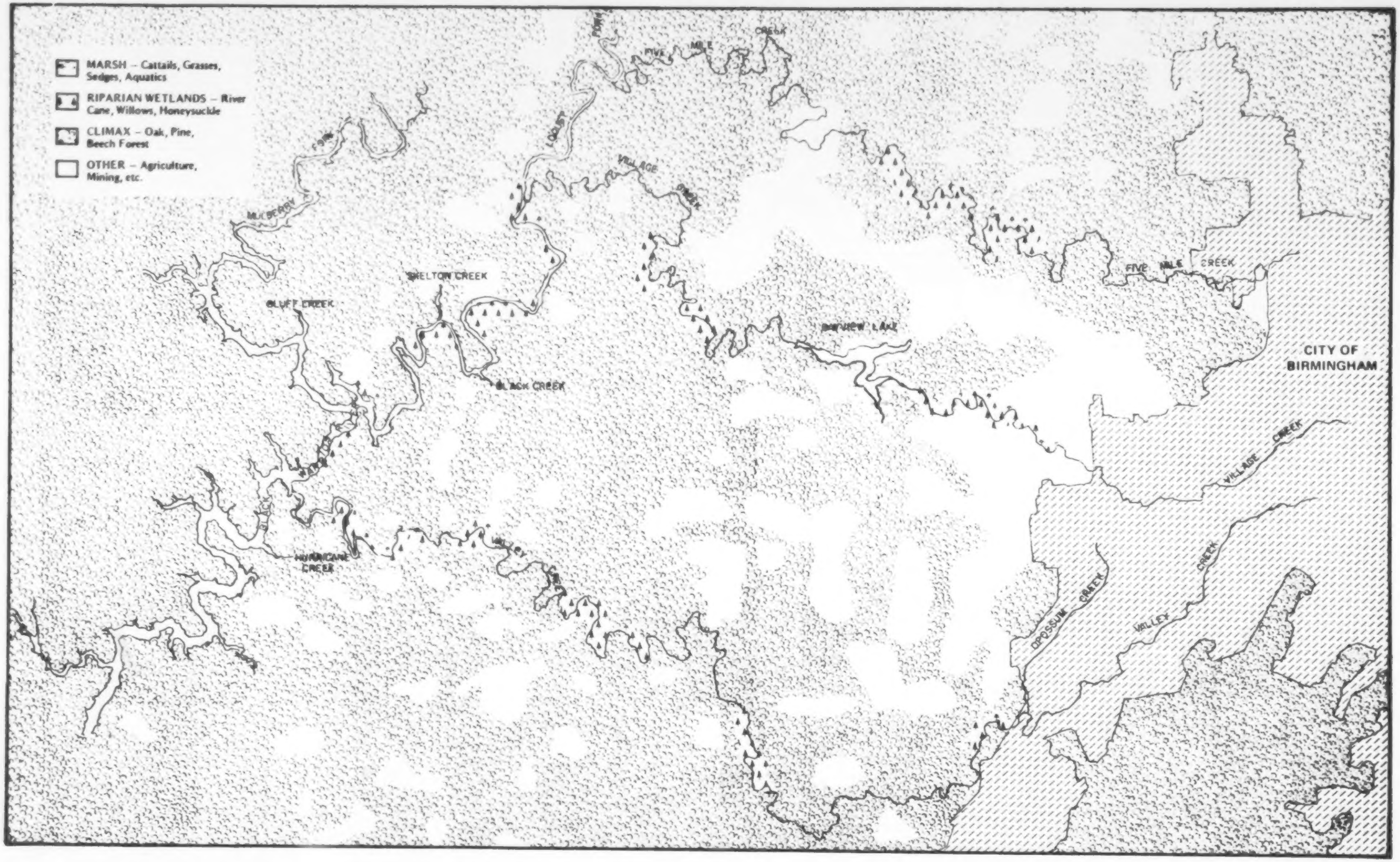

MARSH – Cattails, Grasses, Sedges, Aquatics
RIPARIAN WETLANDS – River Cane, Willows, Honeysuckle
CLIMAX – Oak, Pine, Beech Forest
OTHER – Agriculture, Mining, etc.
MULBERRY FORK
LOCUST FORK
FIVE MILE CREEK
VILLAGE CREEK
SHELTON CREEK
BLUFF CREEK
BLACK CREEK
BAYVIEW LAKE
WARRIOR
BLACK
HURRICANE CREEK
VALLEY CREEK
OPOSSUM CREEK
CITY OF BIRMINGHAM

FIG. 3-43. EXISTING TYPES OF VEGETATIVE COVER

Marsh Areas. The primary marsh area is located contiguous to Bayview Lake. Generally, the upper portions of the lake fringes are characterized by verdant growths of rushes, cattails, sedges, marsh grasses and other aquatic plants, both submerged and emergent. There are small scattered pockets of marshland in some of the low-lying bottom lands. These are somewhat temporary in nature, being characterized as marsh or swamp in periods of heavy rainfall or river flooding.

Riparian Wetlands. Riparian wetlands as used here denotes the gradually sloping stream banks adjacent to the Village and Valley Creeks watersheds. These are characterized by loose sandy soils. Heavy growths of river cane, honeysuckles, willows, and various forbs and terrestrial grasses form the major vegetative cover types. Certain portions of the watershed stream banks are hilly or composed of limestone bluffs. These areas give themselves over to a climax forest.

Climax Forest. By far the greater portion of these watersheds are rolling uplands to steep hills or bluffs. Generally, the upland forest type reaches from the ridges down to the stream banks. There are certain areas where a certain species will dominate. For example, in the areas where extensive lumbering occurs, pines are the predominant species. The upland climax forest type consists primarily of pines, oaks, hickories, beeches, poplars, and gums.

3.2. FUTURE ENVIRONMENT WITHOUT THE PROPOSED ACTION

3.2.1. Ambient Air Quality

3.2.1.1. Introduction

An air quality dispersion model was employed in the prediction of ambient air quality conditions as a result of the proposed action by the U. S. Steel Corporation. A detailed analysis has been provided in the Technical Support Document to the Impact

Statement. By predicting particulate concentrations at monitoring stations, it was found that a reduction of 63 percent would occur as a result of the U. S. Steel modernization program. The results are presented in Table 3-31. The 63 percent reduction is believed to be of the correct order of magnitude; however, there may be limits to and inadequacies in the model. Because of these limits to and inadequacies in the model, the magnitude of the numbers presented in Table 3-31 must be considered with caution. These inadequacies include:

1. All the conditions were run assuming full production rates were in effect.
2. Area sources are not adequately handled by the AQDM.
3. The emission estimates incorporated into the model are based on the latest EPA information and best data available; however, only a portion of the data was obtained from stack sampling analysis.
4. AQDM does not consider variations in terrain which is a serious limitation considering the valley/ridge nature of the Birmingham area.
5. Only emission sources which were under the control of the U. S. Steel Corporation, which emitted significant quantities of particulates and were specifically altered as a result of construction of the Q-BOP, coke battery, or blast furnace, were incorporated into this analysis.
6. The most significant source (up to 50 percent) in the first two conditions was the fugitive emissions from the open-hearth furnace in Fairfield. The AQDM assumes complete dispersion of particulates into the atmosphere, but this is not the case since some sedimentation does occur.

TABLE 3-31

EXPECTED ARITHMETIC MEAN OF PARTICULATES

Station	Grid Position (Km)	Expected Arithmetic Mean of Particulates (Micrograms/cu. meter)			
		Jefferson County's Data	Computer Model* Condition #1 (pre-1972)	Computer Model* Condition #5	Percent Reductions
Bessemer	504.4-3695.5	189-(1966) 130-(1971)	80	25	62
Fairfield	507.9-3704.9	131-(1972)	193	74	61
West End	513.6-3705.5	148-(1967) 130-(1971)	25	10	60
East Thomas	514.0-3709.1	131-(1973)	15	5	67
Birmingham	517.2-3712.4	246-(1966) 215-(1971)	8	3	63
Downtown	517.3-3707.7	161-(1971)	14	5	64
NASN	518.6-3707.0	103-(1972)	16	6	63
Tarrant	521.5-3715.9	203-(1966) 140-(1971)	5	2	60
Woodlawn	522.3-3710.7	144-(1966) 113-(1971)	8	3	63
Mountain Brook	524.1-3703.0	53-(1971)	10	3	70
Huffman	528.7-3717.9	58-(1973)	3	1	67
Irondale	527.2-3710.8	130-(1971)	7	2	71
					Avg. 66 percent

* Contribution from U. S. Steel Emission Sources Only

The limitations described above could result in either over or underprediction of total suspended particulate concentrations. As an example, the model would tend to overpredict emission concentrations as a result of the assumption of full production rates and the assumption that no sedimentation occurred. However, because only U. S. Steel's emission sources were included in the modeling analysis, underprediction of ambient air quality particulate concentrations would occur. Recognizing these limitations of the model and the inability to calibrate and verify the model during the progress of this investigation, it was determined that the primary goal of the modeling analysis would be to describe relative improvements in the ambient air quality in the Birmingham area as a result of the action proposed by the U. S. Steel Corporation.

Each of the five conditions described below was selected, the emission rates developed, and the AQDM employed to project ambient air quality conditions. At the completion of the computation, a relative improvement of conditions 2 through 5, when compared to condition 1, was developed to describe the net improvement in ambient air quality as a result of the actions by the U. S. Steel Corporation. This form of analysis permits the reasonable use of the predictive tool as well as making assumptions with regard to the absolute magnitude of the particulate concentrations which cannot be confirmed at this time The conditions analyzed in this investigation were as follows:

Condition 1. Condition 1 describes the emissions and projects the ambient air quality total suspended particulate concentrations which occurred prior to 1972 from the primary production facilities (coke, iron, and steel) at the Fairfield-Ensley complexes of the U. S. Steel Corporation. The details of the emission rates are described in Appendix A-2.1. The primary facilities included in the analysis are Ensley and Fairfield blast furnaces, Ensley and Fairfield open-hearth furnaces, and Fairfield coke batteries. The emissions also include fugitive emissions from stockpile associated with the above described facilities.

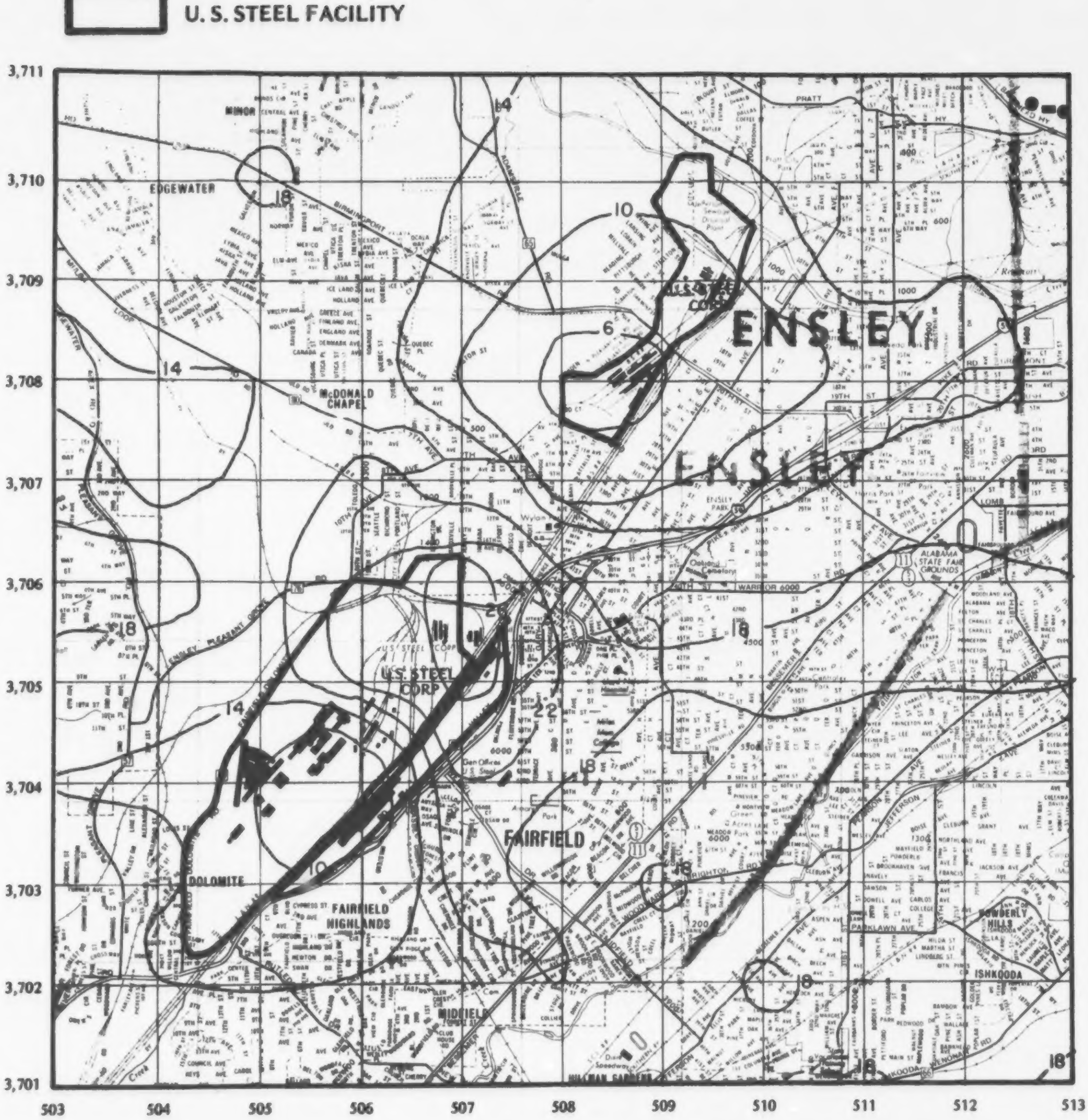
Condition 2. Condition 2 is described in Appendix A-2.5 as emissions from the primary production facilities (coke, iron, and steel) at the Fairfield and Ensley complex if control devices had been employed on pre-1972 operations rather than modernization of the complex. Although admittedly a hypothetical condition, the analysis contains all the same facilities described under Condition 1; specifically, these facilities were Ensley and Fairfield blast furnaces, Ensley and Fairfield open-hearth furnaces, and Fairfield coke batteries. This condition represents the future condition without the modernization, at state implementation emission limits.

Condition 3. Condition 3 is intended to describe existing conditions occurring in the U. S. Steel complex at state implementation emission limits. It includes blast furnaces and coke batteries at full production level plus the addition of two Q-BOP furnaces which have been previously constructed and are presently in operation at the Fairfield facilities.

Condition 4. Condition 4 describes interim operations during the start-up of the proposed facilities. During this period, it is anticipated that three blast furnaces will exist at Ensley Works, four blast furnaces at Fairfield Works, and three Q-BOP's and five coke batteries at Fairfield Works. The emission levels from each of these sources are based on full production of facilities.

Condition 5. Condition 5 describes the final configuration of facilities after the modernization program with the three blast furnaces at Ensley Works shut down, a total of four coke batteries in operation at Fairfield Works, plus the existing and replacement Q-BOP's and the existing and new blast furnaces at Fairfield Works.

The results of the analysis for each of these conditions are presented in Figures 3-44 through 3-47. The figures depict the percentage reduction of the U. S. Steel Corporation's contribution to ambient TSP concentrations referred to as Condition 1. Additionally, Figures 3-48 through 3-52 give the absolute magnitudes of the ambient


U. S. STEEL FACILITY
3,711
3,710
3,709
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3,706
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3,704
3,703
3,702
3,701
503
504
505
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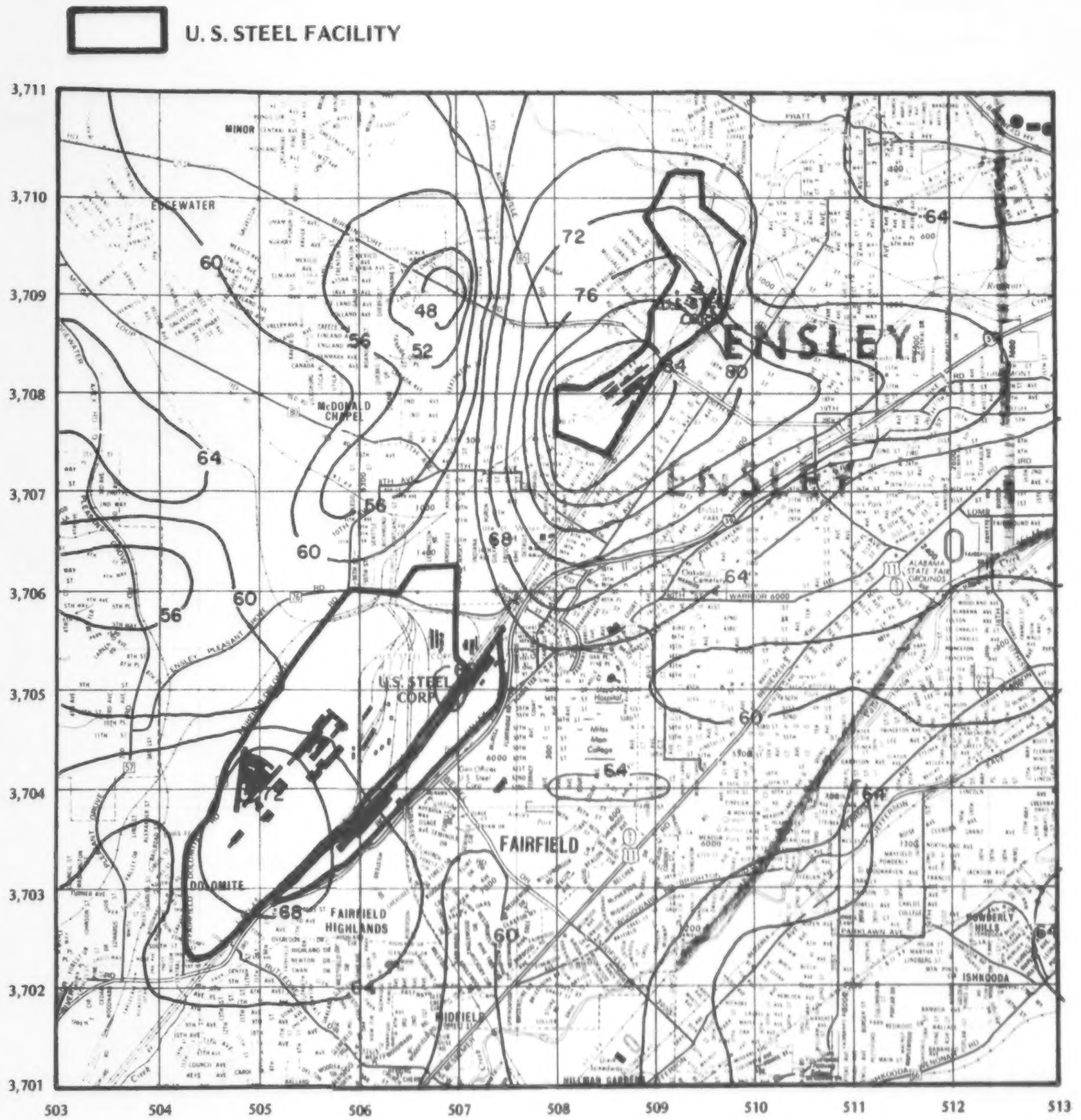
507
508
509
510
511
512
513
EDGEWATER
MINOR
McDONALD CHAPEL
ENSLEY
U.S. STEEL CORP
FAIRFIELD
DOLOMITE
FAIRFIELD HIGHLANDS
MIDFIELD
PRATT
ALABAMA STATE FAIR GROUNDS
POWDERLY HILLS
ISHKOODA
14
18
10
6
14
18
26
22
14
18
18
10
18
8
18
18

FIG. 3-44. PERCENT REDUCTION OF USSC CONTRIBUTION TO AMBIENT PARTICULATE CONCENTRATIONS FOR CONDITION 2
% = (CONDITION 1 – CONDITION 2)/CONDITION 1 x 100



U. S. STEEL FACILITY
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72
76
48
52
56
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64
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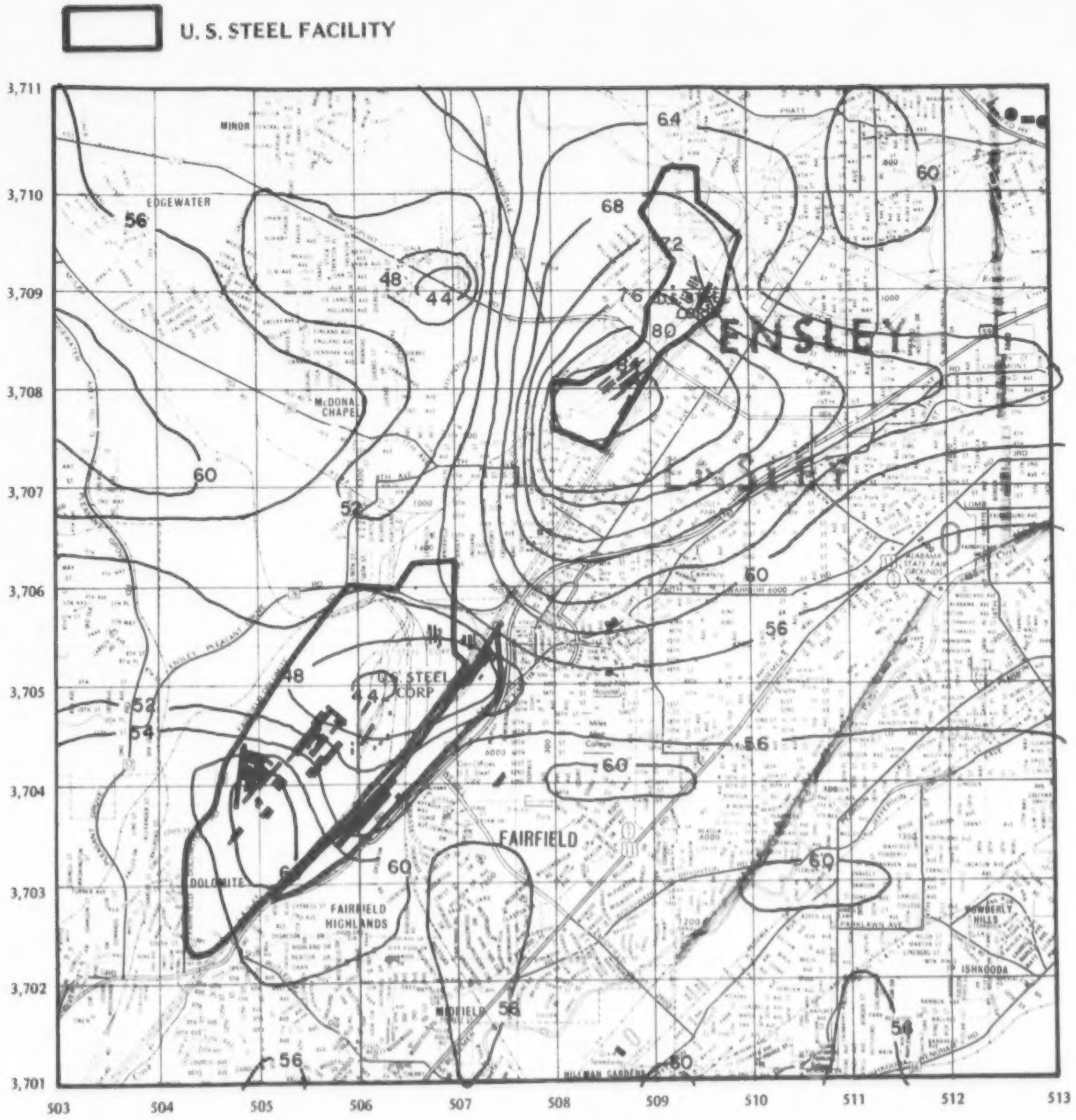
80
84
ENSLEY
EDGEWATER
MINOR
McDONALD CHAPEL
U.S. STEEL CORP
FAIRFIELD
FAIRFIELD HIGHLANDS
DOLOMITE
MIDFIELD
PRATT
ALABAMA STATE FAIR GROUNDS
WYLAM
ISHKOODA
WARRIOR 6000
Miles Main College

FIG. 3-45. PERCENT REDUCTION OF USSC CONTRIBUTION TO AMBIENT PARTICULATE CONCENTRATIONS FOR CONDITION 3
% = (CONDITION 1 – CONDITION 3)/CONDITION 1 x 100



U. S. STEEL FACILITY
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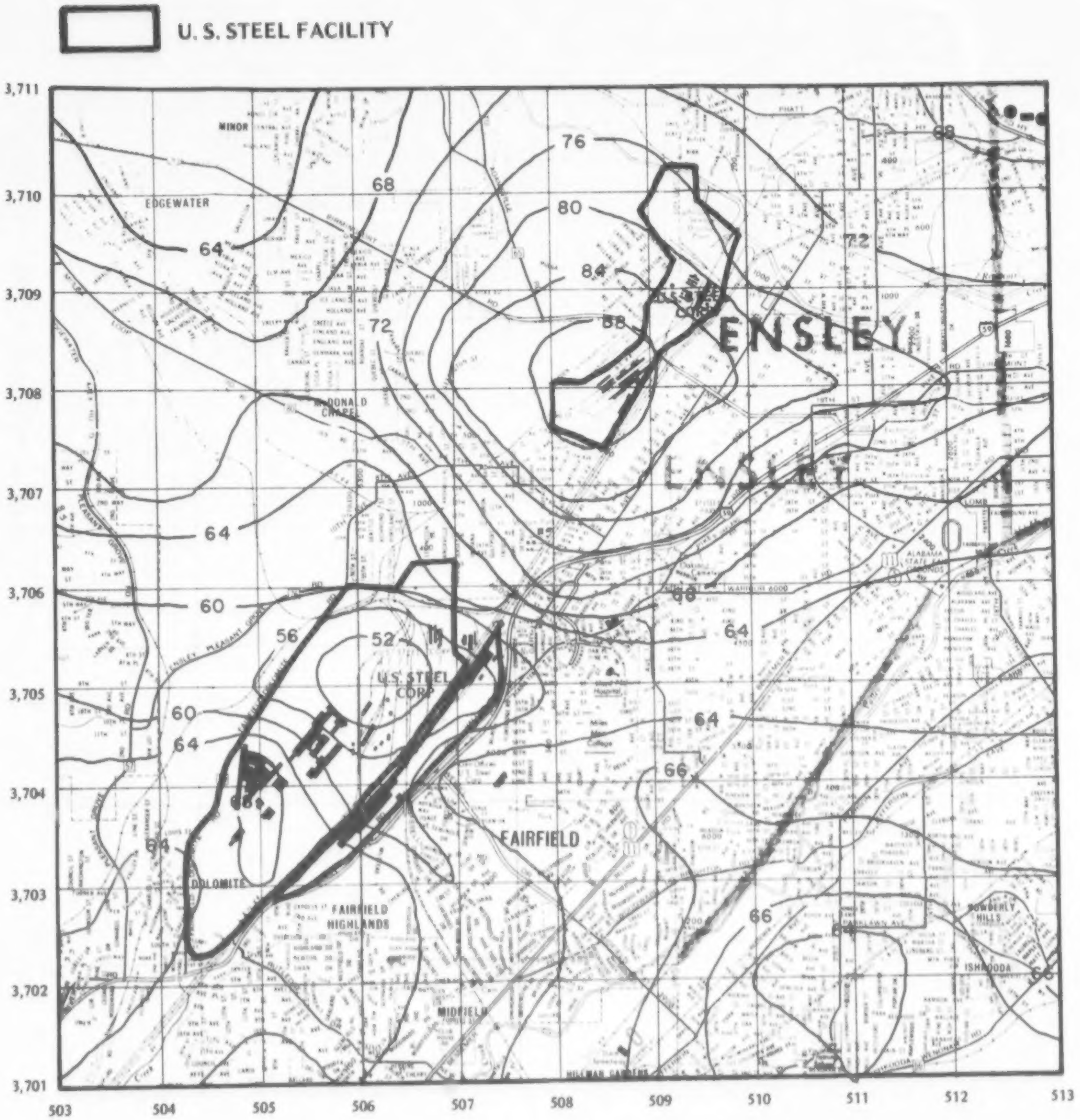
MINOR
EDGEWATER
McDONALD CHAPEL
ENSLEY
U.S. STEEL CORP
FAIRFIELD
FAIRFIELD HIGHLANDS
DOLOMITE
MIDFIELD
ALABAMA STATE FAIR GROUNDS
POWDERLY HILLS
ISHKOODA
PRATT
64
60
68
72
76
80
56
48
44
60
52
60
56
48
44
52
54
56
60
60
60
56
56
56
60
56

FIG. 3-46. PERCENT REDUCTION OF USSC CONTRIBUTION TO AMBIENT PARTICULATE CONCENTRATIONS FOR CONDITION 4
% = (CONDITION 1 – CONDITION 4)/CONDITION 1 x 100


U. S. STEEL FACILITY
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MINOR
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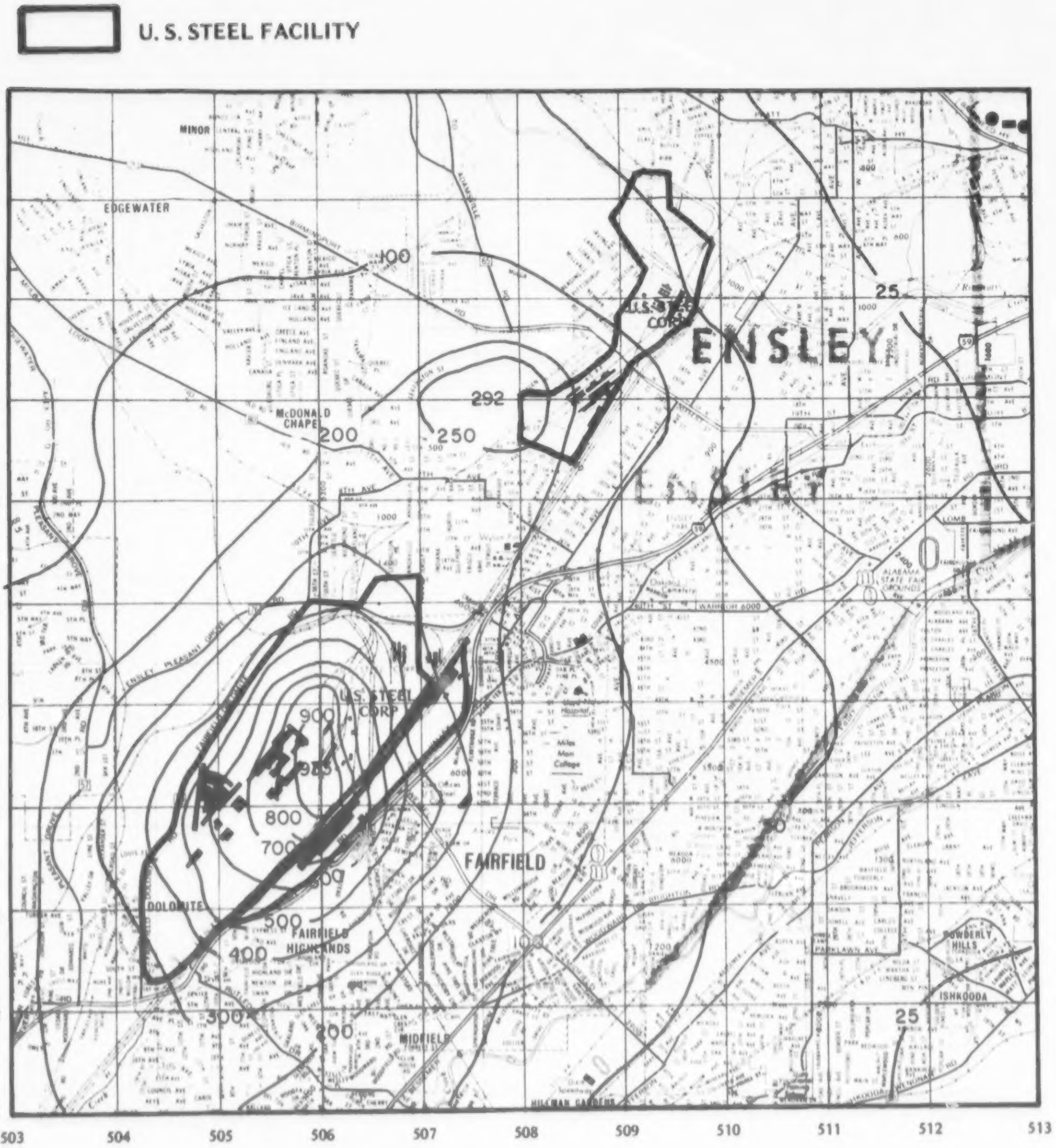
McDONALD CHAPEL
ENSLEY
U.S. STEEL CORP
FAIRFIELD
DOLOMITE
FAIRFIELD HIGHLANDS
MIDFIELD
ISHKOODA
WARRIOR
76
80
84
88
68
72
64
64
64
60
56
52
60
64
68
64
64
66
66
66
64
68
68

FIG. 3-47. PERCENT REDUCTION OF USSC CONTRIBUTION TO AMBIENT PARTICULATE CONCENTRATIONS FOR CONDITION 5
% = (CONDITION 1 – CONDITION 5)/CONDITION 1 x 100


U. S. STEEL FACILITY
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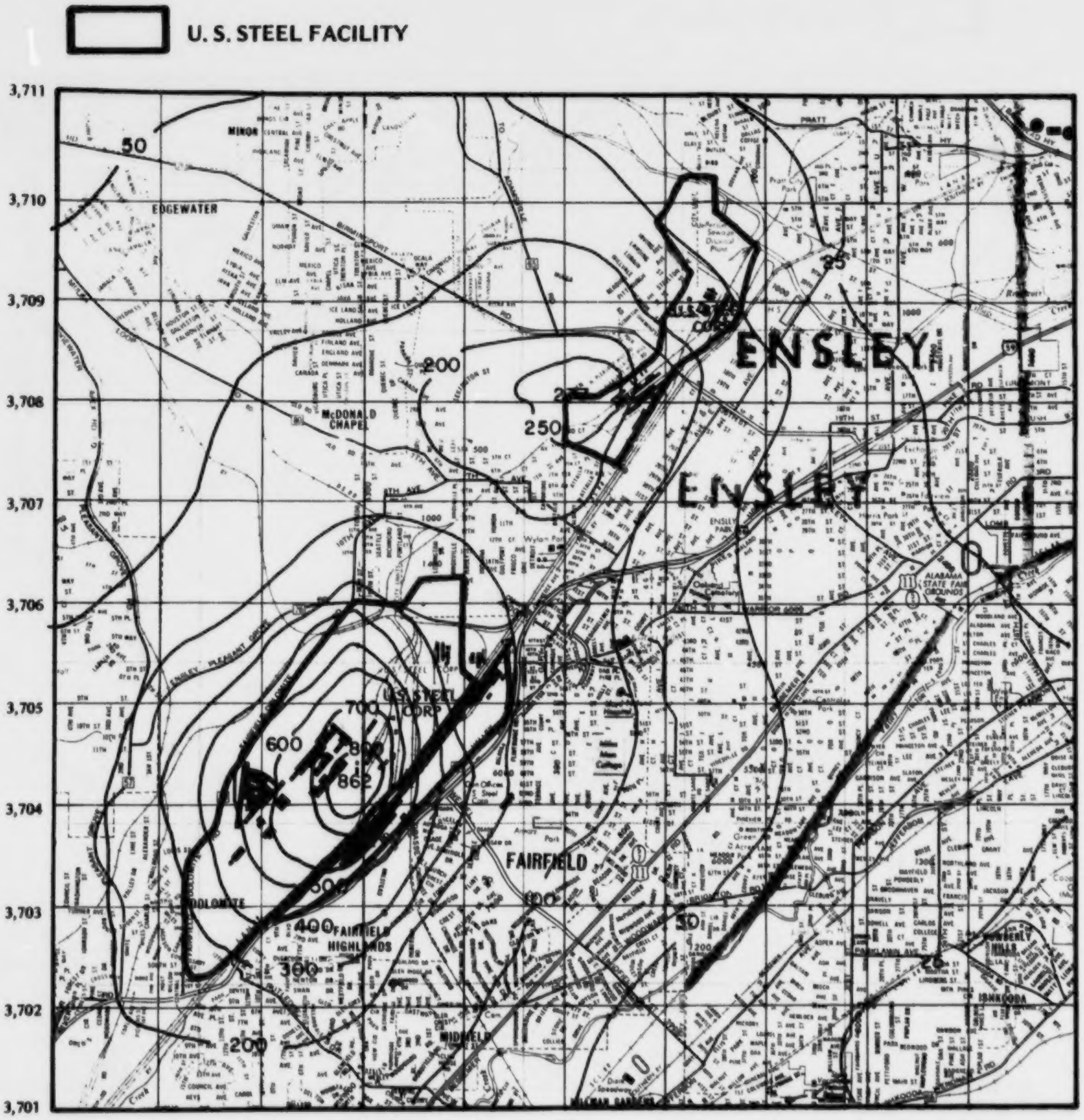
MINOR
EDGEWATER
McDONALD CHAPEL
ENSLEY
U.S. STEEL CORP
FAIRFIELD
DOLOMITE
FAIRFIELD HIGHLANDS
MIDFIELD
POWDERLY HILLS
ISHKOODA
HILLMAN GARDENS
Miles College
100
200
250
292
900
985
800
700
600
500
400
300
200
25
25

FIG. 3-48 USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 1



U. S. STEEL FACILITY
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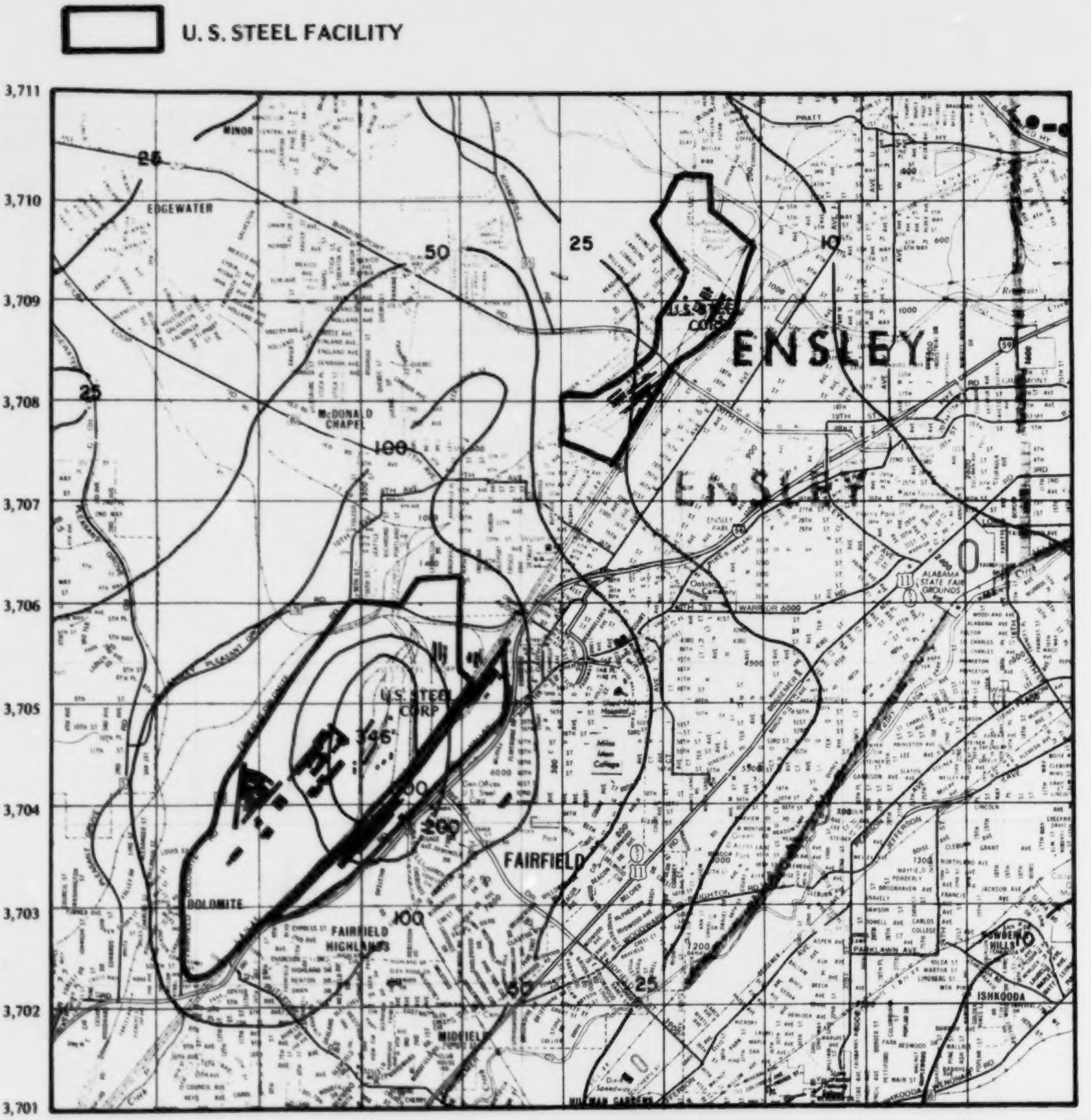
512
513
50
EDGEWATER
MINOR
McDONALD CHAPEL
200
250
35
ENSLEY
ENSLEY
USS STEEL CORP
700
600
800
862
500
400
300
200
FAIRFIELD
FAIRFIELD HIGHLANDS
DOLOMITE
MIDFIELD
ALABAMA STATE FAIR GROUNDS
25
0

FIG. 3-49. USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 2


U. S. STEEL FACILITY
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EDGEWATER
MINOR
PRATT
McDONALD CHAPEL
ENSLEY
U.S. STEEL CORP
FAIRFIELD
DOLOMITE
FAIRFIELD HIGHLANDS
MIDFIELD
ALABAMA STATE FAIR GROUNDS
POWDERLY
ISHKOODA
25
50
25
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100
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300
200
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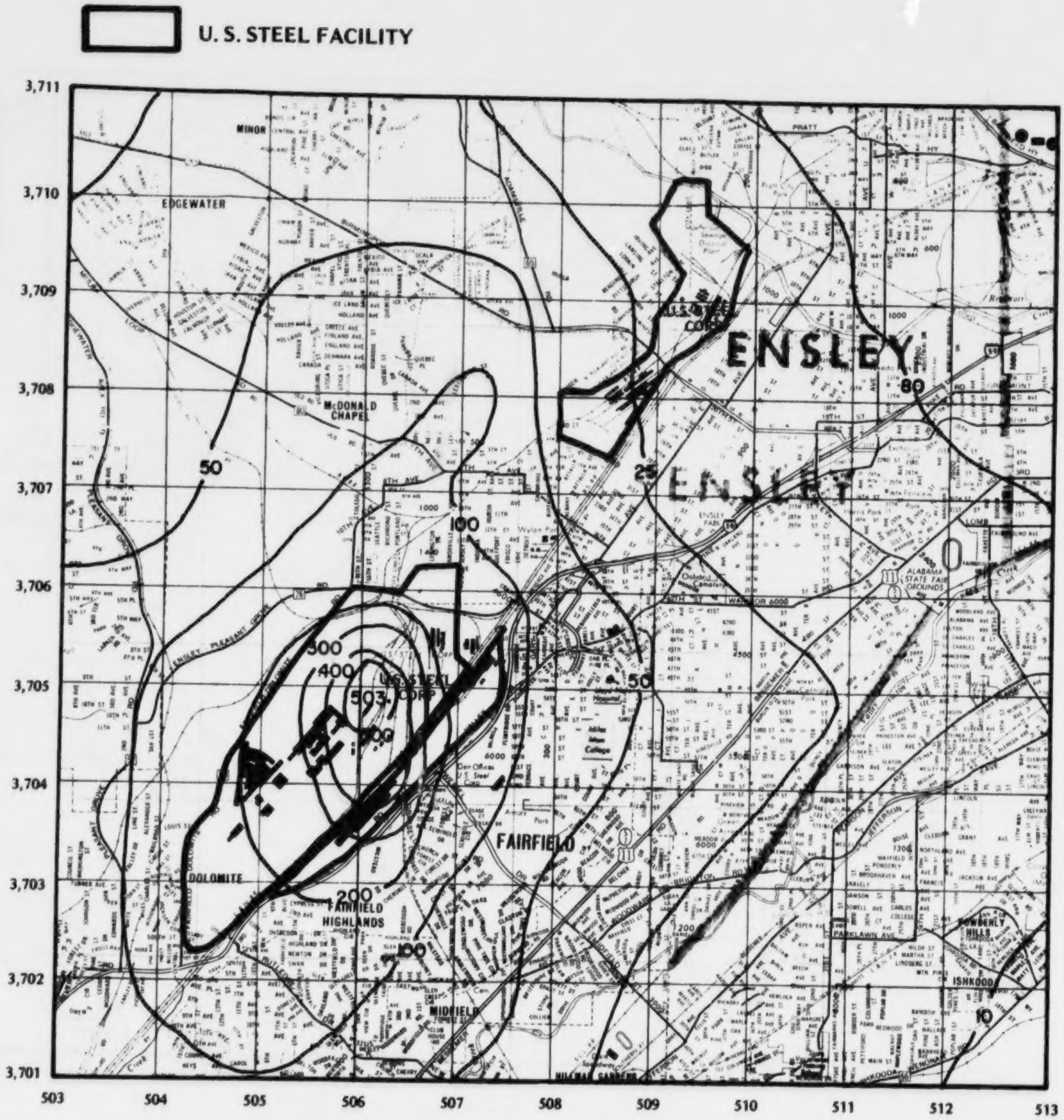
FIG. 3-50 USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 3


U. S. STEEL FACILITY
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MINOR
EDGEWATER
McDONALD CHAPEL
ENSLEY
ENSLEY
U.S. STEEL CORP
FAIRFIELD
DOLOMITE
FAIRFIELD HIGHLANDS
MIDFIELD
ALABAMA STATE FAIR GROUNDS
PRATT
10
25
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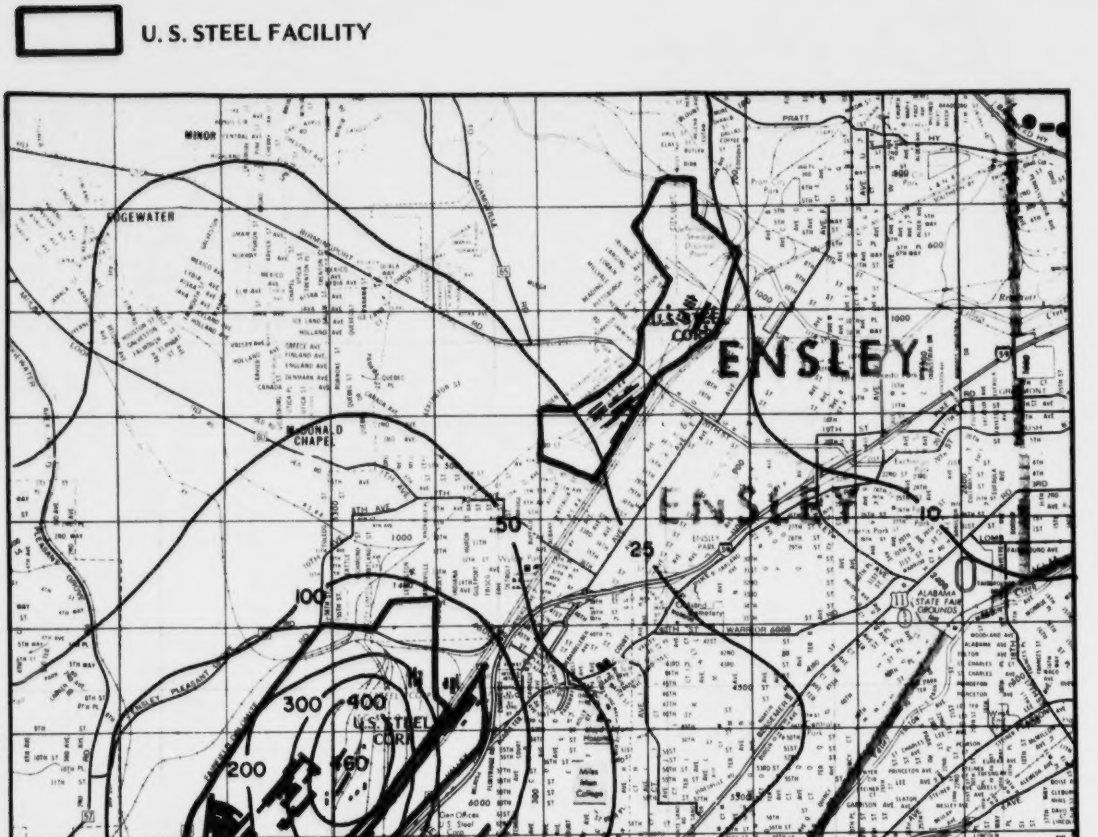
503
600

FIG. 3-51. USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 4


U. S. STEEL FACILITY
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3,702
3,701
503
504
505
506
507
508
509
510
511
512
513
460
400
300
200
100
50
25
10
ENSLEY
ENSLEY
U.S. STEEL CORP.
U.S. STEEL CORP.
EDGEWATER
MINOR
McDONALD CHAPEL
FAIRFIELD
FAIRFIELD HIGHLANDS
DOLOMITE
MIDFIELD
ALABAMA STATE FAIR GROUNDS
ISHKOODA
HILLMAN GARDENS
PRATT

FIG. 3-52. USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 5

TSP concentrations. These figures should be approached with caution because of the limitations and inadequacies in the model.

3.2.1.2. Future Conditions Without the Proposed New Sources

Of the five conditions analyzed during the ambient air quality investigations, Condition 2 represents future conditions without the proposed new source. Based on discussions in the alternatives chapter of this document, it appears that the Condition 2 situation would not have been economically feasible. An analysis of Condition 2 which describes the ambient air quality resulting from pre-1972 equipment complying with the State Implementation Plan emission limitations indicates that the ambient air quality concentrations in Jefferson County will exceed those that will occur as a result of the proposed action (Condition 5), which is total modernization.

Figure 3-45 presents reduction of U. S. Steel's contribution to ambient TSP concentrations for Condition 2. Condition 2 represents the existing ambient air quality for the pre-1972 sources controlled with best available control technology. Condition 1, pre-1972 conditioning, was used as the standard condition in the calculation of the percent reductions. Inspection of this figure identifies a significant reduction in total suspended particulates as a result of employing best available control technology on existing facilities. Percent reduction calculations were also performed for Conditions 3, 4, and 5. The results are presented in Figures 3-46, 3-47, and 3-48, respectively. Further discussion of Condition 5 appears later in this document. Other pollutant emissions (SO_2, hydrocarbons, CO, NO_x) are not anticipated to change significantly as a result of this action. The Environmental Protection Agency has determined that the increase in hydrocarbon emissions from the preheater on the new coke oven battery will be subject to the offset policy requirements presented in Section 129 of the 1977 New Clean Air Act Amendments.

3.2.2. Water Quality

3.2.2.1. Future Conditions Without the Proposed Facilities

For the purpose of this discussion, it has been assumed that only the blast furnace is considered as a new source and, therefore the wastes from that source will be addressed with regard to their influence on environmental impact. Based on the analysis presented herein, it does not appear that small alterations of any dischargers to these streams will cause a significant improvement, or degradation of the existing water quality. However, it is anticipated, based on its present design, that the discharge from the Valley Creek STP will double, resulting in a degradation of the existing water quality. It should be emphasized that not only point source, but non-point source discharges, which are substantially more difficult to control, contribute to the poor water quality conditions presently existing in Opossum and Valley Creeks.

Village Creek would exist in a condition similar to that presently occurring without the proposed action. It should be emphasized, however, that substantial reductions in organic loads as a result of the final construction and operation of the new municipal waste treatment facilities on Village Creek will reduce the organic loads to the system and will improve water quality conditions to some extent. Nevertheless, accurate projections of these improvements would be difficult considering the existing state of the water quality conditions of Village Creek, and furthermore, considering upstream contaminants which may be caused by point or non-point source discharges, the final water quality conditions may not be improved greatly.

3.2.3. Biology

3.2.3.1. Future Without the Proposed Action

Previous sections have pointed out the significant variation in physical stream characteristics and susceptibility of Village, Valley and Opossum Creek to the extreme flow and temperature variations. These variations can be directly attributed to land use practices and wastewater discharges associated with the headwaters of each of the aforementioned streams. Recently Frazier (1972) has pointed out that velocity is a dominant physical factor affecting stream life. Most stream dwelling species are adapted to and require particular flow velocities. Tolerance ranges are rather narrow and often will vary with different stages of the life cycle. Behavioral influences directly related to current velocities include spawning, egg development, juvenile growth, adult life, and migratory habits. Also velocity may indirectly determine food and habitat availability through its influence on invertebrate life, turbidity, erosion and sedimentation. Generally high stream velocities associated with flood flow conditions have adverse effects on stream biota (Darnell, 1976). The data developed by Elwood and Waters (1969) indicate that severe flooding can have a devastating effect on the young of the year class fishes and significantly reduce the density of older fishes. Studies conducted in California by Seegrist and Gard (1972) indicate that flooding can change the species composition of a stream dramatically and that these effects can persist for several years. Extreme low flow conditions can also greatly affect the stability from aquatic community structure. Discontinuance flow reduces the stream habitat to a series of isolated pools which subsequently become stagnant thus exposing the surviving fishes and invertebrates to a greater predation by both aquatic and terrestial organisms (Larimore, 1963). Unstable or severely alternating stream flow characteristics create an environment that few aquatic species can tolerate. In such incidences extreme velocities occur under natural conditions; populations existing in such habitats are characterized by repeated invasion and subsequent demise (Darnell, 1976). The addition of other environmental factors, i.e., the introduction of toxic substances into streams subject to extreme variation in velocities would be expected to accelerate the break-down of a stable aquatic community structure.

Streams subject to extreme flow variations are in most cases subject to extreme temperature fluctuations. This is especially true for those streams that are impacted by construction activities such as channelization as well as those streams that receive significant concentrations of runoff from impervious substances associated with industrial, commercial and high density residential land uses. The upper reaches of Opossum, Village and Valley Creeks have been shown to fall within this category. The magnitude of thermal insult does not have to be of a degree to directly kill aquatic organisms in order to endanger any species within the aquatic community. Damage to the aquatic community structure can occur well within the zone of tolerance, since temperature may act as a catalyst, a depressant, an activator, a restrictor, a stimulator and a controller of biological metabolism (U. S. Department of the Interior, 1967). Temperature has been shown to significantly affect metabolism, respiration, behavior, distribution and migratory habits, feeding rates, growth and reproduction, as well as the susceptibility of fish to parasites and diseases (De Silva, 1969). Temperature has also been shown to enhance the effects of other toxic agents within the aquatic environment. The summary of combined and synergistic effects of toxic materials on fish by De Silva (1969) and more recently by Middlebrooks (1973) leads to two general conclusions: toxicity frequently increases with increased temperature and organisms subjected to toxic materials are less tolerant of temperature extremes.

Based on the biological, chemical and physical information of Opossum, Valley and Village Creeks, even without the proposed action none of these streams will recover with any degree of rapidity. To bring all of the aforementioned factors into focus a Recovery Index and an

Inertia Index proposed by Cairns and Dickson (1975) and personal communication with Dickson (1977) have been utilized. The Recovery Index contains the following considerations:

1. Existence of nearby epicenters for providing organisms to reinvade a damaged system. (From the biological--fish, invertebrates and periphyton--and physical evaluations of the three systems studies, the existence of nearby epicenters is rated as poor.)
2. Transportability or mobility of dissemules--the dissemules might be spores, eggs, larvae, flying adults which might lay eggs, or other stages in the life history of an organism which permits it either voluntarily or involuntarily to move to a new area. (From the fact that no fish and only a few invertebrates were found in Opossum at the upstream reference, the transportability rating for Opossum is poor. Using the same biological indicators the rating for Valley and Village is moderate.)
3. Condition of the habitat following pollutional stress. (Physical habitats--riffles, pools, shelves, etc.---in Village and Valley Creeks are good and without pollutional loads should allow for excellent diversity development. For this reason both creeks are given a habitat rating of good. Opossum Creek has very little habitat diversity due to a tar-like substrate and is given a rating of poor.)
4. Presence of residual toxicants following pollutional stress. (Based upon sediment analysis

for heavy metals and organics all streams are rated with large amounts of residual toxicants.)

5. Chemical-physical environmental quality after pollutional stress. (Village and Valley Creeks are given a rating of moderate for chemical-physical environmental quality. This is based on the fact that physical substratum has not been significantly altered. Opossum on the other hand is rated as being in severe disequilibrium.)

6. Management or organizational capabilities for immediate and direct control of damaged area. (All creeks are rated with some management or organizational capabilities due to the existing 208 studies in Jefferson County.)

In a classification of less than 55 to greater than 400, Opossum has a rating of 2, Valley and Village have values of 48. None of the streams have a good chance of making a rapid recovery in an environment without the proposed action.

Inertia has been defined by the developers of the index as the ability of an aquatic community or ecosystem to resist displacement of disequilibrium in regards to either structure or function, i.e., a stream with a high Inertia Index has a high degree of inertia and will not change from its present state without a great deal of effort. In contrast a stream with poor environmental inertia will alter itself from its present situation with slight alterations. The Inertia Index includes the following considerations:

1. Indigenous organisms accustomed to highly variable environmental conditions.

Based upon collections of fish, periphyton, and benthic macroinvertebrates the following ratings have been assigned: Opossum had no fish, only tolerant invertebrates and only a few algal species and is rated as good since those organisms found are able to withstand wide ranges of stress; Valley and Opossum are rated as moderate because a greater diversity of all organisms was observed.

2. System has high structural and functional redundancy.

Classification of all 3 streams is moderate in regard to structural and functional redundancy, because each system is neither complex (mature) nor one with absence of fractionation of activities. These streams rather fall somewhere between these two extremes.

3. Stream order, flow dependability, turbulent diffusivity, and flushing capacity.

Stream order, flow dependability, turbulent diffusity and flushing capacity are not considered dependable in any of the three systems in the light of carrying away toxicity. For this reason all streams are rated poor.

4. Hard, well-buffered water antagonistic to toxic substances.

The water of all 3 systems is hard (<250 hardness as $CaCO_3$ and well-buffered) (Alkalinity 50-90). As a result, the general effect is one of antagonism to toxic parameters observed. Rating for all streams is good.

5. System close to a major ecological transitional threshold (e.g., from a cold to a warm water fishery).

None of the streams are close to a major ecological transitional threshold. Opossum experiences periodic thermal fluctuations, but they are unpredictable and inconsistent. Rating for all streams is with a substantial margin of safety.

6. Presence of a drainage basin management group with a water quality monitoring program.

All streams were given a weak rating. This is reflective of the extended period of time which will be required to improve these streams.

In a classification of less than 55 to greater than 400, Opossum has a rating of 108, Valley and Village have values of 72. This index shows that all three streams have a moderate degree of inertia, i.e., a moderate ability to resist their present disequilibrium. This indicates that if all of the present perturbations were removed, the streams would recover. This statement must be evaluated in light of the Recovery Index previously discussed which indicated that recovery would not be rapid. This is not a contradiction but shows only that the tendency to return to a normal (unstressed) situation exists. However, due to residual toxins, etc. this will not occur without a large degree of environmental change.

Based on the above information, the future of Opossum, Valley, and Village Creeks will continue to be a stressed situation. The presence of high concentrations of toxicants in the sediments will persist for long periods of time without the construction of the new blast furnace. Also, water quality will continue to be degraded due to non-point discharge, extreme temperature and flow variations, and the general misuse by the public through solid waste disposals.

3.2.4. Socio-Economic Conditions

3.2.4.1. Future Environment Without the New Source

To simulate economic impacts to the region a 50 percent decline in regional steel production is assumed (Birmingham Regional Planning Commission). A total 1980 steel and iron products value is estimated at $738,469,000, therefore, a 50 percent reduction would reflect an output decline of $369,235,000. This would associate with a decline of 11,234 employees and a payroll loss of $127,854,000 based on an annual salary of $11,381 per employee. In terms of disposable personal income, $102,411,000 is available for spending ($95,242,000 for personal consumption expenditures; $7,169,000 for housing). Total projected decreases are thus:

(1973)	Personal Consumption Related	$102,411,000
	Decreased Steel Production	369,235,000
(1973)	TOTAL DECREASE	$471,646,000

It can be assumed that a decline in regional steel production would cause other sectors in the overall regional economy to contract. This assumption establishes criteria against which alternatives can be evaluated. These changes are listed in Table 3-32. A regional income multiplier of 1.96 is established when the total productive output reduction is divided by the value added decrease. In other words, each dollar loss resulting from base realignment results in an additional loss of 96 cents in the regional economy.

Employment changes in other sectors will result from this simulated change to the economy. These are reflected in Table 3-33. Direct employment losses would be 11,234, therefore, the additional 13,104 job losses reflect a regional employment multiplier of 2.16. That is, each direct job loss results in an additional 1.16 job losses.

TABLE 3-32

IMPACT ANALYSIS (IN MILLIONS OF DOLLARS)
BRPC STEEL SIMULATION, 1980

		TOTAL OUTPUT REDUCTION	TOTAL V.A. REDUCTION
1.01	Livestk+Livestk Products	1.636	0.624
1.02	Field + Orchard Crops	0.458	0.348
1.03	Forestry + Fishery Prods	0.150	0.091
1.04	Agri, Forst + Fish Servc	0.434	0.235
2.04	Coal Mining	6.203	4.232
2.05	Crude Petrol + Nat Gas	0.727	0.547
2.06	Stone + Clay Mining	1.130	0.824
3.01	Food + Kindred Products	17.191	5.526
3.05	Fabrics, Yarns + Threads	1.155	0.478
3.07	Tire Cord+Misc Text Gds	0.013	0.005
3.09	Apparel Frm Purchsd Matr	3.530	1.779
3.10	Misc Fabricated Text Prd	0.264	0.118
4.01	Sawmills + Planing Mills	0.354	0.150
4.02	Veneer + Plywood	0.305	0.116
4.03	Lmbr+Wood Prd Ex Contnrs	0.905	0.447
4.04	Wooden Containers	0.054	0.022
4.05	Household Furniture	0.643	0.329
4.06	Othr Furn + Fixtures	0.060	0.034
4.07	Pulp + Papr Prd Ex Contnrs	1.104	0.517
4.08	Paperbrd Containers+Boxe	0.619	0.265
5.01	Petrol Refng + Reltd Prd	3.448	0.665
5.02	Paving Mix+Asphalt Prd	0.322	0.151
5.03	Industrl Inorg+Org Chem	4.446	2.615
5.04	Fertilizers	0.025	0.008
5.05	Agri Chem Ex Fertlzrs	0.019	0.009
5.06	Misc Chem Prd	1.301	0.643
5.07	Plast Mtrls+Resin+Syn Ru	0.053	0.025
5.08	Org Manmade Fibers	0.038	0.023
5.09	Drugs	0.100	0.076
5.10	Cleaning Preparations	0.164	0.091
5.11	Toilet Preparations	0.133	0.093
5.12	Paints + Allied Prd	0.360	0.169
5.13	Tires + Innertubes	0.154	0.079
5.14	Othr Rubber Prd	0.079	0.044
5.15	Manifac Plastics Prd	0.176	0.098
6.01	Glass + Glass Prd	0.007	0.004
6.02	Cement+Lime+Gypsum Prd	0.462	0.279
6.03	Clay+Cement Prd+Refactrs	5.085	2.764
6.04	Othr Nonmet Mineral Prd	0.238	0.132

TABLE 3-32 (Cont'd)

IMPACT ANALYSIS (IN MILLIONS OF DOLLARS)
BRPC STEEL SIMULATION, 1980
(continued)

		TOTAL OUTPUT REDUCTION	TOTAL V.A. REDUCTION
7.01	Primary Iron + Steel	401.980	184.714
7.02	Primary Copper	0.587	0.159
7.03	Primary Aluminum	0.766	0.277
7.04	Othr Prim Nonferrous Met	2.153	0.699
8.01	Metal Cans	0.084	0.035
8.02	Metal Barrels,Drum+Pails	0.059	0.023
8.03	Met Sanit+Plumbing Prd	0.031	0.015
8.04	Nonelec Heating Equip	0.103	0.051
8.05	Fab Structural Metal Prd	0.358	0.174
8.06	Screw Mach Prd+Stamping	2.519	1.234
8.07	Othr Fab Metal Prd	6.241	3.395
9.02	Gen Indus Mach+Equip	3.278	1.797
9.03	Machine Shop Prd	2.692	1.867
10.03	Mining Machinery	0.063	0.031
10.05	Mtrl-Hndlng Mach Ex Truc	0.309	0.179
10.06	Indust Trucks + Tractors	0.003	0.002
10.07	Metal Working Machinery	0.172	0.111
10.08	Specl Indstry Machinery	0.483	0.274
11.01	Motor Vehicles + Parts	1.923	0.534
11.02	Aircraft + Parts	0.087	0.043
11.04	Locomivs+Rail+St Cars	0.027	0.010
11.05	Cycles, Trailers, etc.	0.012	0.005
12.01	Elec Measuring Instrumts	0.001	0.001
12.02	Elec Motors + Generators	0.012	0.007
12.03	Industrl Controls, etc.	0.526	0.301
12.05	Light Fixt+Wiring Device	0.306	0.166
12.06	Electrnc Compnts+Access	0.007	0.004
12.07	Misc Electrical Machinry	0.008	0.005
13.01	Servc Industry Machinery	0.041	0.019
13.02	Household Appliances	0.044	0.022
13.03	Radio, TV+Commun Equip	0.011	0.006
14.01	Scientific Instrmnts,etc	0.022	0.013
14.02	Med,Surgcl,Dental Instr	0.037	0.023
14.03	Watches, Clocks + Parts	0.002	0.001
14.04	Optical+Opthalmic Goods	0.023	0.014
14.05	Photo Equip + Supplies	0.006	0.004
15.03	Office Supplies	1.171	-0.000
16.01	Ordnance + Accessories	0.041	0.024
16.02	Othr Misc Prd	2.131	1.194

TABLE 3-32 (Cont'd)

IMPACT ANALYSIS (IN MILLIONS OF DOLLARS)
BRPC STEEL SIMULATION, 1980
(continued)

		TOTAL OUTPUT REDUCTION	TOTAL V.A. REDUCTION
17.01	Railroads+Relatd Servcs	8.062	5.459
17.02	Local+Highway Passngr TR	1.122	0.710
17.03	Motor Freight+Warehouse	11.921	6.762
17.04	Water Transportation	0.469	0.237
17.05	Air Transport	0.301	0.177
17.07	Transportation Services	0.053	0.038
18.01	Telecommunication	6.541	5.390
18.02	Electric Power	10.892	8.069
18.03	Gas	6.493	2.457
18.04	Water + Sanitary Service	0.446	0.263
19.01	New Const.Nonfarm Resid	7.169	2.954
19.05	Maintenance+Repair Const	8.811	4.806
20.01	Wholesale+Retail Trade	36.531	27.358
20.02	Finance + Insurance	18.292	9.390
20.03	Real Estate + Rental	13.244	11.328
20.04	Advertising	4.096	3.256
20.05	Othr Bls+Prof Services	12.749	8.085
20.06	Bus Travel,Enter+Gifts	3.491	0.000
21.01	Printing + Publishing	2.429	1.638
21.02	Radio + TV Broadcasting	0.002	0.001
21.03	Hotels + Lodging Places	0.938	0.561
21.04	Persnl+Repar Serv.Ex Car	3.886	2.595
21.05	Automobile Repair+Servc	3.104	1.726
21.06	Amusements	1.117	0.583
21.07	Medical + Health Service	5.139	3.805
21.08	Educat Servc+Nonprof Org	6.691	4.074
22.01	Post Office	1.155	0.887
	Total	657.009	334.699

TABLE 3-33

IMPACT ANALYSIS, BRPC STEEL SIMULATION, 1980

		EMPLOYMENT REDUCTION
1.01	Livestk+Livestk Products	99
1.02	Field + Orchard Crops	28
1.03	Forestry + Fishery Prods	3
1.04	Agri, Forst + Fish Servc	26
2.04	Coal Mining	266
2.05	Crude Petrol + Nat Gas	10
2.06	Stone + Clay Mining	43
3.01	Food + Kindred Products	211
3.05	Fabrics, Yarns + Threads	46
3.07	Tire Cord+Misc Text Gds	1
3.09	Apparel Frm Purchsd Matr	142
3.10	Misc Fabricated Text Prd	11
4.01	Sawmills + Planing Mills	22
4.02	Veneer + Plywood	10
4.03	Lmbr+Wood Prd Ex Contnrs	37
4.04	Wooden Containers	4
4.05	Household Furniture	40
4.06	Othr Furn + Fixtures	2
4.07	Pulp+Papr Prd Ex Contnrs	29
4.08	Paperbrd Containers+Boxe	18
5.01	Petrol Refng + Reltd Prd	12
5.02	Paving Mix+Asphalt Prd	4
5.03	Industrl Inorg+Org Chem	75
5.04	Fertilizers	1
5.05	Agri Chem Ex Fertlzrs	1
5.06	Misc Chem Prd	35
5.07	Plast Mtrls+Resin+Syn RU	1
5.08	Org Manmade Fibers	1
5.09	Drugs	2
5.10	Cleaning Preparations	2
5.11	Toilet Preparations	2
5.12	Paints + Allied Prd	7
5.13	Tires + Innertubes	4
5.14	Othr Rubber Prd	4
5.15	Manufac Plastics Prd	9
6.01	Glass + Glass Prd	0
6.02	Cement+Lime+Gypsum Prd	10
6.03	Clay+Cement Prd+Refactrs	146
6.04	Othr Nonmet Mineral Prd	12

TABLE 3-33 (Cont'd)

IMPACT ANALYSIS, BRPC STEEL SIMULATION, 1980 (continued)

		EMPLOYMENT REDUCTION
7.01	Primary Iron + Steel	13,261
7.02	Primary Copper	11
7.03	Primary Aluminum	26
7.04	Othr Prim Nonferrous Met	74
8.01	Metal Cans	2
8.02	Metal Barrels,Drum+Pails	2
8.03	Met Sanit+Plumbing Prd	1
8.04	Nonelec Heating Equip	3
8.05	Fab Structural Metal Prd	13
8.06	Screw Mach Pro+Stamping	129
8.07	Othr Fab Metal Prd	312
9.02	Gen Indus Mach+Equip	102
9.03	Machine Shop Prd	231
10.03	Mining Machinery	3
10.05	Mtrl-Hndlng Mach Ex Truc	8
10.06	Indust Trucks + Tractors	0
10.07	Metal Working Machinery	6
10.08	Specl Indstry Machinery	17
11.01	Motor Vehicles + Parts	26
11.02	Aircraft + Parts	2
11.04	Locomtvs+Rail+St Cars	1
11.05	Cycles, Trailers, etc.	2
12.01	Elec Measuring Instrumts	0
12.02	Elec Motors + Generators	0
12.03	Industrl Controls, etc	22
12.05	Light Fixt+Wiring Device	12
12.06	Electrnc Compnts+Access	0
12.07	Misc Electrical Machinry	0
13.01	Servc Industry Machinery	1
13.02	Household Appliances	2
13.03	Radio,TV+Commun Equip	0
14.01	Scientific Instrmnts,etc	1
14.02	Med.Surgcl,Dental Instr	2
14.03	Watches,Clocks + Parts	0
14.04	Optical+Opthalmic Goods	1
14.05	Photo Equip + Supplies	0
15.03	Office Supplies	100
16.01	Ordnance + Accessories	1
16.02	Othr Misc Prd	95
17.01	Railroads+Relatd Servcs	278
17.02	Local+Highway Passngr Tr	37
17.03	Motor Freight+Warehouse	603

TABLE 3-33 (Cont'd)

IMPACT ANALYSIS, BRPC STEEL SIMULATION, 1980 (continued)

		EMPLOYMENT REDUCTION
17.04	Water Transportation	14
17.05	Air Transport	15
17.07	Transportation Services	5
18.01	Telecommunication	317
18.02	Electric Power	184
18.03	Gas	126
18.04	Water + Sanitary Service	4
19.01	New Const.Nonfarm Resid	183
19.05	Maintenance+Repair Const	110
20.01	Wholesale+Retail Trade	3,120
20.02	Finance + Insurance	683
20.03	Real Estate + Rental	150
20.04	Advertising	17
20.05	Othr Bus+Prof Services	809
20.06	Bus Travel,Enter+Gifts	185
21.01	Printing + Publishing	150
21.02	Radio + TV Broadcasting	5
21.03	Hotels + Lodging Places	81
21.04	Persnl+ Repar Serv. Ex Car	173
21.05	Automobile Repair+Servc	95
21.06	Amusements	68
21.07	Medical + Health Service	577
21.08	Educat Servc+Nonprof Org	398
22.01	Post Office	105
	Total	24,338

4. DETAILED DESCRIPTION OF THE PROPOSED PROJECT

CHAPTER 4

DETAILED DESCRIPTION OF THE PROPOSED PROJECT

4.1. PHYSICAL FACILITIES

4.1.1. Construction

The new blast furnace will take a minimum of 29 months to construct with a possible manpower peaking period around the twentieth month. Estimated peaking daily manpower requirement will be approximately 1,200 men during construction. The Birmingham SMSA will provide the major percentage of this work force except for certain specialty subcontractors.

Blast furnace No. 8 will be characteristic of the larger capacity, higher top pressure facilities being constructed by the industry during this decade. The use of beneficiated fuels has increased output as well as assisted control of the process from environmental considerations. The three products of operation--molten iron, slag, and blast furnace gas--are all of value and will be utilized.

4.1.1.1. Location

Blast Furnace. Blast furnace No. 8 will be located immediately north of existing blast furnace No. 7 at Fairfield operations. Fairfield Works is an integrated steelmaking facility located within Opossum Valley and southwest of the City of Fairfield, Alabama. Fairfield operations cover approximately 5,000 acres. The blast furnace complex area plan (as shown in Figures 4-1 and 4-2) will occupy 13.15 acres.

Materials Storage. The storage layout is shown in Figure 4-1. The materials will be in a stockhouse area, 1,100 feet north of the new blast furnace. Supply of materials to the blast furnace will be by means of hoppers and conveyor belts.

Waste Treatment Facilities. The waste treatment facilities are shown on Figure 4-2, and are located approximately 600 feet southwest of the blast furnace.

Slag Pits. Slag will be dumped into two slag pits immediately north of the blast furnace proper for cooling (see Figure 4-1). The slag pits will be used alternately until emptied and conveyed to Exum Landfill (see Figure 4-10).

Service Facilities. The location of the service facilities will be immediately north of facilities for blast furnace Nos. 7, 6, and 5, which run north to south. This will allow existing transportation facilities--railroad lines, roads, utility lines, etc.--to be easily adapted to the new facility.

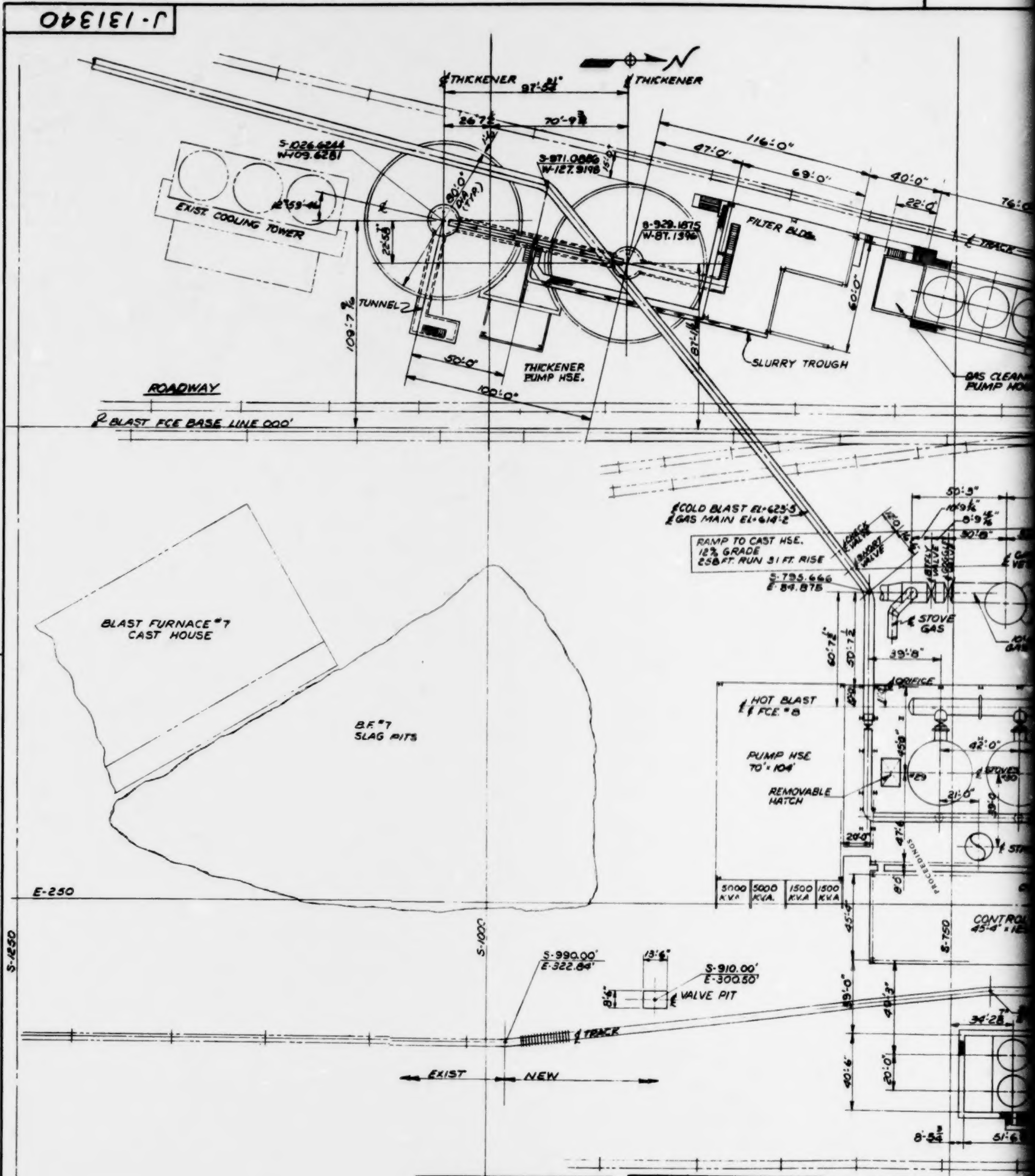
4.1.1.2. Methods

Organization. This type of construction requires many specialty contractors. Accordingly, U. S. Steel Corporation will manage the activities of its contractors.

Scheduling. Clearing and grubbing of 13.15 acres of land will be followed by foundation and drainage activities. Foundations will be engineered and vary with the equipment and structure requirements. Caissons will be excavated down to supporting rock for heavy structures. The bedrock is limestone with anticipated sinkholes and other discontinuities. In the event such discontinuities are encountered, spread footings will be used for major structures. The structural contractor will then follow, erecting the furnace, superstructure, stoves, supporting facilities, etc. The mechanical, piping, and electrical work will be started as construction permits.

4.1.1.3. Requirements

Equipment. The major equipment items to be used on this project are as follows:


J-131340
THICKENER
THICKENER
97'-5 3/4"
26'-7 1/2
70'-9 3/4
116'-0"
47'-0"
69'-0"
40'-0"
22'-0"
76'-0
S-1026.6244
W-109.6281
S-971.0886
W-127.9198
S-929.1875
W-87.1396
80'-0" DIA (TYP)
12'-53'-4 1/2"
EXIST. COOLING TOWER
22'-5 3/4"
TUNNEL
109'-7 1/2
FILTER BLDG.
TRACK
60'-0"
50'-0"
100'-0"
THICKENER PUMP HSE.
SLURRY TROUGH
GAS CLEANING PUMP HOUSE
ROADWAY
BLAST FCE BASE LINE 000'
COLD BLAST EL+625'-5
GAS MAIN EL+614'-2
RAMP TO CAST HSE.
12% GRADE
258 FT. RUN 31 FT. RISE
CHECK VALVE
SHORT VALVE
BFLY VALVE
GOGGLE VALVE
S-795.666
E-84.875
50'-9"
10'-9 1/4"
8'-9 15/16"
30'-8"
STOVE GAS
60'-7 1/2
50'-7 1/2
39'-8"
ORIFICE
HOT BLAST
FCE. #8
PUMP HSE
70'×104'
REMOVABLE HATCH
42'-0"
STOVES
21'-0"
20'-0"
47'-6
8'-0
PROCEEDINGS
5000 K.V.A
5000 K.V.A.
1500 K.V.A
1500 K.V.A
45'-4"
CONTROL
45'-4" × 1
S-750
BLAST FURNACE #7 CAST HOUSE
B.F. #7 SLAG PITS
E-250
S-1250
S-1000
S-990.00'
E-322.84'
13'-6"
S-910.00'
E-300.50'
8'-6"
VALVE PIT
TRACK
EXIST
NEW
49'-0"
49'-3"
34'-2 3/4
40'-6"
20'-0"
8'-5 3/4
51'-6

A

MICROFILM SCALE

3" ON ORIGINAL

0 EIGHTHS 1 2 3 TENTHS

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BY S. Willek DATE 1/10/78

SPEC. NO. 536-4357-3000 ADD. B

INITIAL RELEASE NO. 3 DATE 1/10/78

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RELEASED FOR CONSTRUCTION

BY Nicholas Daniel DATE 1/1/77

SPEC. NO. 536-4351-3006 ADD. 1

INITIAL RELEASE NO. 1 DATE 1/1/77

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United States Steel Corporation
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RELEASED FOR CONSTRUCTION

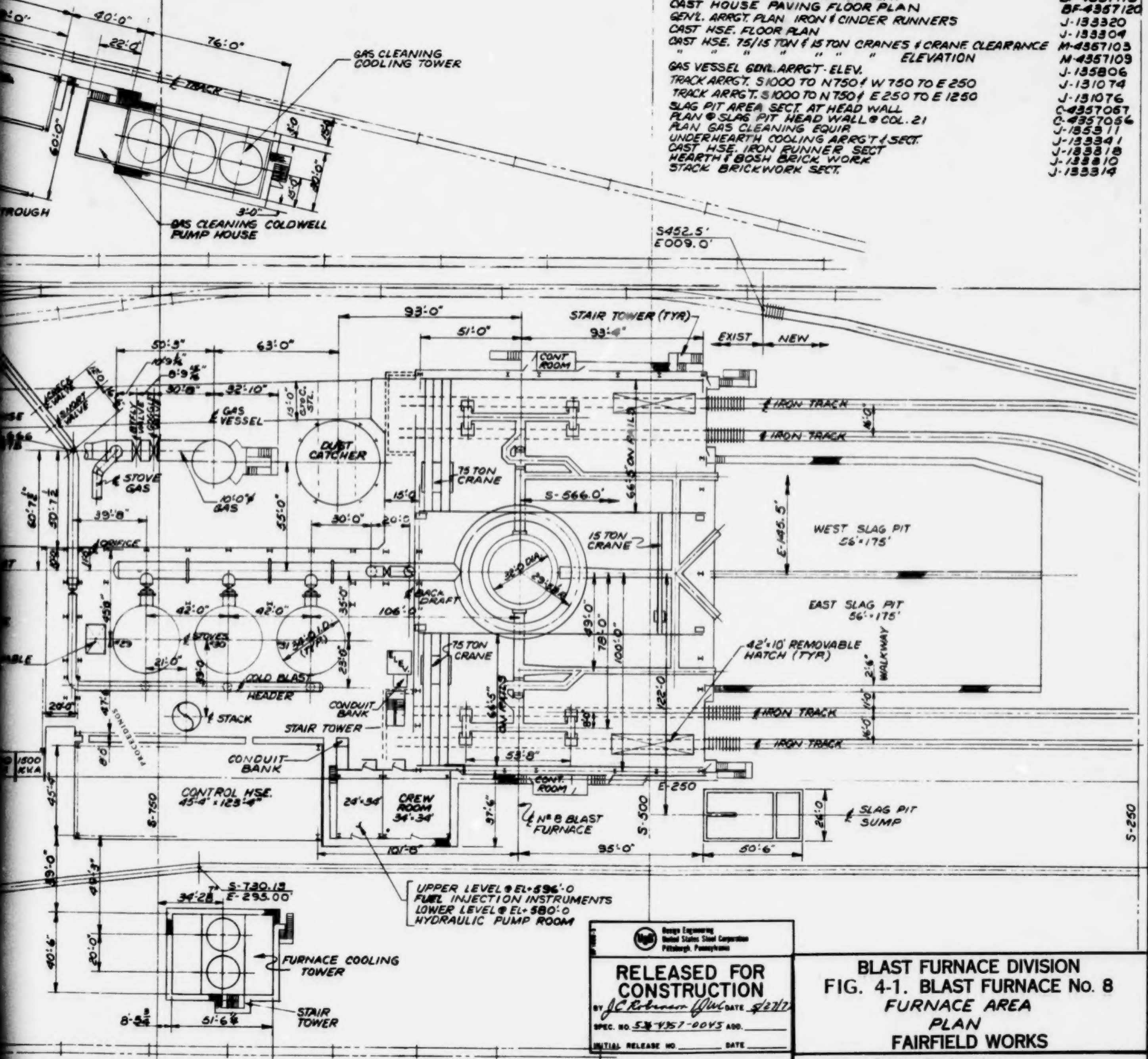
BY L. J. Mitts DATE 12/15/76

SPEC. NO. 536-4351-0047 ADD. A

INITIAL RELEASE NO. 1 DATE 12/17/76

REFERENCE DWG'S.

SLAG PIT LAYOUT	BF-4357135
THICKENER ARRG'T PLAN	BF-4357146
COLD BLAST & CLEAN GAS MAIN ROUTING & SUPPORT ARRG'T.	J-131128
GAS CLEANING EQUIPMENT ELEV.	J-131310
PUMP HOUSE EQUIPMENT LOCATION	J-131343
FILTER BUILDING EQUIPMENT LAYOUT	J-135302
STOVES AREA PLAN	BF-4357022
CREW HSE & FUEL INJECTION INST. LAYOUT PLAN	BF-4357096
CONTROL HOUSE ARRANGEMENT	BF-4357115
CAST HOUSE PAVING FLOOR PLAN	BF-4357120
GEN'L. ARRGT. PLAN IRON & CINDER RUNNERS	J-133320
CAST HSE. FLOOR PLAN	J-133304
CAST HSE. 75/15 TON & 15 TON CRANES & CRANE CLEARANCE	M-4357103
" " " " " " " ELEVATION	M-4357109
GAS VESSEL GEN'L. ARRG'T - ELEV.	J-135806
TRACK ARRGT. S1000 TO N750 & W 750 TO E 250	J-131074
TRACK ARRGT. S1000 TO N750 & E 250 TO E 1250	J-131076
SLAG PIT AREA SECT. AT HEAD WALL	C-4357067
PLAN @ SLAG PIT HEAD WALL @ COL. 21	C-4357056
PLAN GAS CLEANING EQUIP.	J-135311
UNDERHEARTH COOLING ARRG'T & SECT.	J-133341
CAST HSE. IRON RUNNER SECT	J-133318
HEARTH & BOSH BRICK WORK	J-133310
STACK BRICKWORK SECT.	J-133314


40'-0"
22'-0"
76'-0"
60'-0"
GAS CLEANING COOLING TOWER
℄ TRACK
TROUGH
3'-0"
15'-0"
30'-0"
GAS CLEANING COLDWELL PUMP HOUSE
S452.5'
E009.0'
93'-0"
51'-0"
STAIR TOWER (TYP.)
93'-4"
EXIST
NEW
50'-3"
63'-0"
CONT. ROOM
CHECK VALVE
BLEEDER VALVE
GAS VESSEL
DUST CATCHER
℄ IRON TRACK
℄ IRON TRACK
75 TON CRANE
℄ STOVE GAS
10'-0" ⌀ GAS
S-566.0'
64'-5" ON RAILS
E-145.5'
WEST SLAG PIT 56'×175'
39'-8"
30'-0"
20'-0"
15'-0"
ORIFICE
15 TON CRANE
32'-0" DIA.
BACK DRAFT
106'-0"
42'-0"
42'-0"
STOVES
EAST SLAG PIT 56'×175'
ELEV.
75 TON CRANE
42'×10' REMOVABLE HATCH (TYP.)
WALKWAY
COLD BLAST HEADER
CONDUIT BANK
℄ STACK
STAIR TOWER
℄ IRON TRACK
℄ IRON TRACK
CONDUIT BANK
53'-8"
CONT. ROOM
1500 KVA
CONTROL HSE. 45'-4" × 123'-4"
S-750
24'×34'
CREW ROOM 34'×34'
℄ Nº 8 BLAST FURNACE
S-500
E-250
℄ SLAG PIT SUMP
S-250
101'-8"
95'-0"
50'-6"
S-730.13
E-295.00
34'-2⅞"
FURNACE COOLING TOWER
STAIR TOWER
8'-5¾"
51'-6⅛"
S-690'

UPPER LEVEL @ EL+596'-0
FUEL INJECTION INSTRUMENTS
LOWER LEVEL @ EL+580'-0
HYDRAULIC PUMP ROOM

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BY J C Robinson DATE 5/27/77
SPEC. NO. 536-4357-0045 ADD. ____
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United States Steel Corporation
Pittsburgh, Pennsylvania

RELEASED FOR CONSTRUCTION
BY Y. J. Mitt DATE 12/15/76
SPEC. NO. 536-4351-0047 ADD. A
INITIAL RELEASE NO. 1 DATE 12/17/76

REV.	DATE	MADE / CHKD.	DESCRIPTION	FILM ROLL NO.
8				
7				
6				
5				
4	4-8-76	MB	RELOCATED THICKENERS	
3	2-16-76	[illegible]	ALTERED THICKENERS FILTER BLD. & GAS CLEAN. COOLING TOWER	
2	1-15-76	[illegible]	ALTERED PUMP HOUSE LOCATION	
1	12-23-75	[illegible]	CHG'D SIZE & LOCATION OF GAS CLEANING COOLING TOWER	

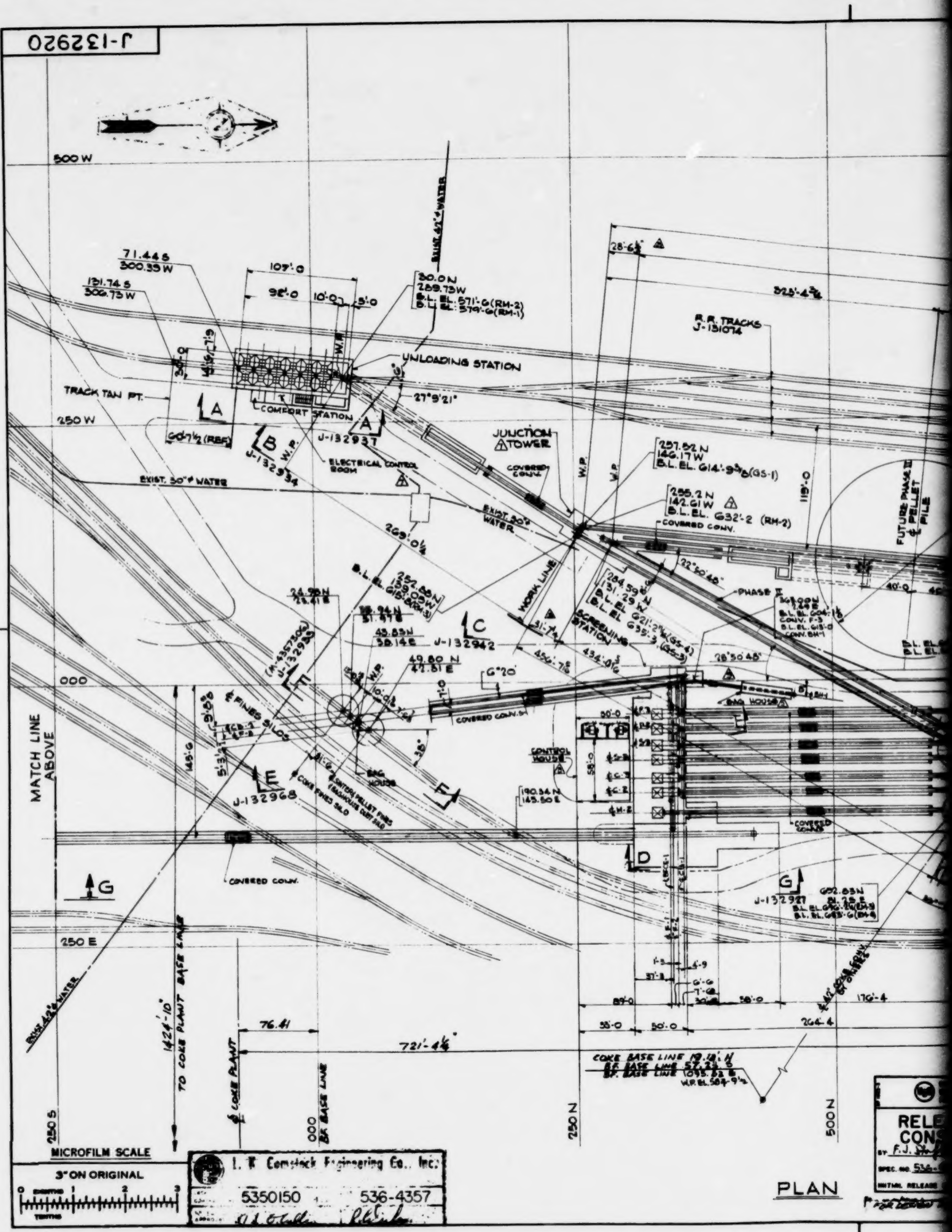
BLAST FURNACE DIVISION
FIG. 4-1. BLAST FURNACE No. 8
FURNACE AREA
PLAN
FAIRFIELD WORKS

Design Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

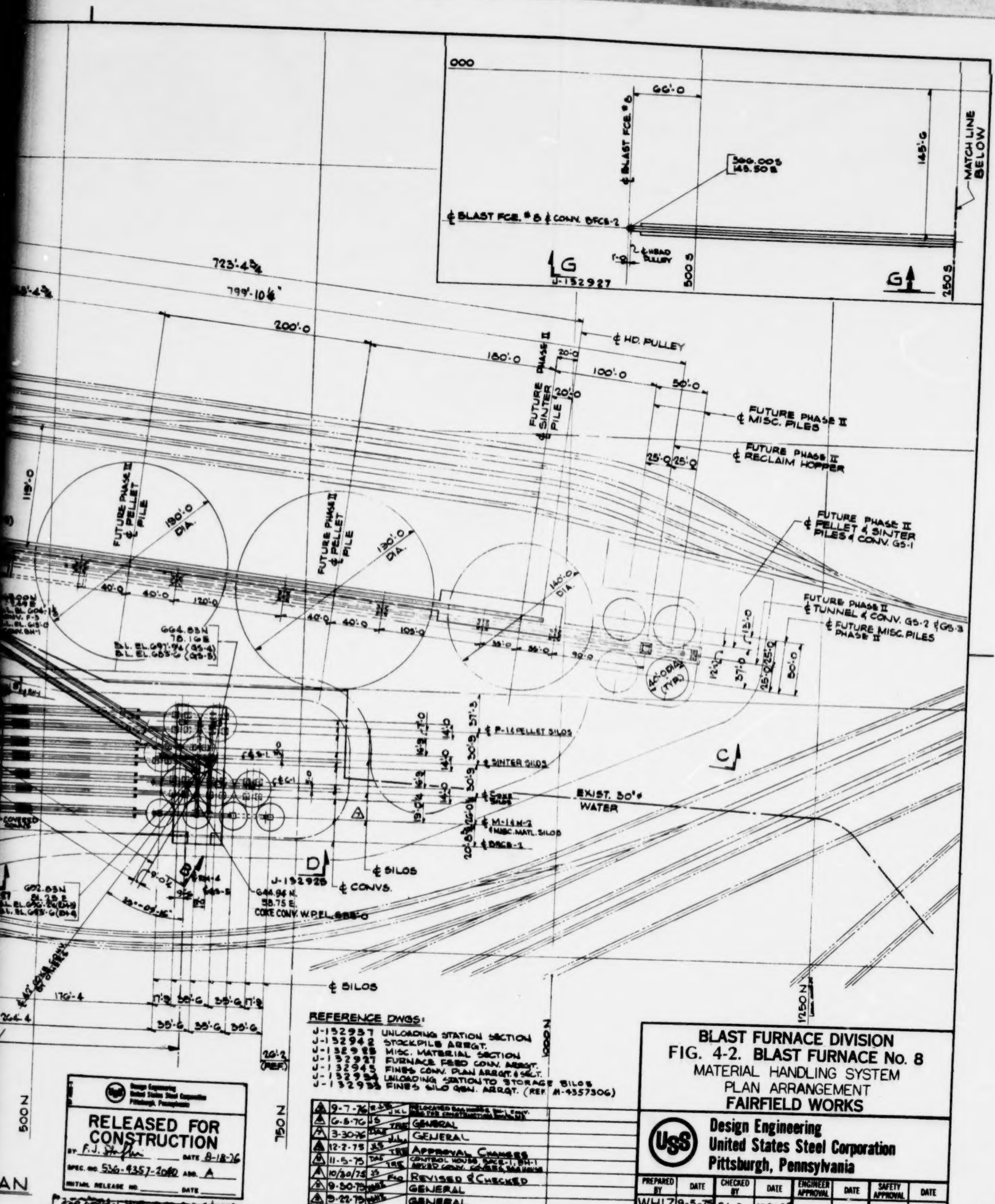
PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SAFETY APPROVAL	DATE
R. HAAG	12-13-75	MB	4-8-76	Y J M	12/15/76		

PROJECT NO.	SCALE	
536-4357	1" = 30'-0	J-131340

B


J-132920
500 W
BURR 42" ⌀ WATER
71.44 S
300.39 W
131.74 S
306.73 W
107'-0
98'-0
10'-0
5'-0
30.0 N
289.73 W
B.L. EL. 571'-6 (RM-2)
B.L. EL. 579'-6 (RM-1)
W.P.
UNLOADING STATION
TRACK TAN PT.
A
COMFORT STATION
27°9'21"
250 W
66'-7½ (REF)
B
J-132934
A
J-132937
ELECTRICAL CONTROL ROOM
JUNCTION TOWER
COVERED CONV.
EXIST. 30" ⌀ WATER
EXIST. 30" ⌀ WATER
269'-0¼
28'-6½"
325'-4⅜
R.R. TRACKS
J-131074
257.52 N
146.17 W
B.L. EL. 614'-9⅜ (GS-1)
255.2 N
142.61 W
B.L. EL. 632'-2 (RM-2)
COVERED CONV.
119'-0
FUTURE PHASE II ℄ PELLET PILE
22°50'48"
PHASE II
40'-0
WORK LINE
284.59 N
131.29 W
B.L. EL 621'-2⅝ (GS-4)
B.L. EL 635'-3 (GS-3)
SCREENING STATION
252.88 N
139.05 W
B.L. EL. 615'-8 (RM-3)
24.98 N
23.41 E
38.94 N
51.47 E
45.83 N
38.14 E
49.80 N
47.51 E
C
J-132942
31'-7¼
456'-7⅛
434'-0⅜
28°50'48"
6°20'
COVERED CONV.
BAG HOUSE
000
(A-4357306)
J-132933
F
℄ FINES SILOS
℄ CB-2
℄ CP-2
10'-0⅛
36°
E
J-132968
℄ COKE FINES SILO
℄ SINTER PELLET FINES (BAGHOUSE DUST SILO)
BAG HOUSE
F
CONTROL HOUSE
190.34 N
145.50 E
30'-0
58'-0
℄ S-2A
℄ C-3
℄ C-2
℄ M-2
COVERED CONVS.
D
G
J-132927
652.83 N
81.25 E
B.L. EL. 676'-2⅛ (BH-3)
B.L. EL. 683'-6 (BH-4)
MATCH LINE ABOVE
145'-6
G
COVERED CONV.
250 E
EXIST. 42" ⌀ WATER
1424'-10"
TO COKE PLANT BASE LINE
76.41
721'-4⅛
℄ COKE PLANT
000
BF. BASE LINE
250 S
250 N
500 N
1'-3
4'-9
37'-3
6'-6
7'-6
89'-0
30'-0
58'-0
176'-4
55'-0
50'-0
264'-4
42" COKE CONV. BY OTHERS
COKE BASE LINE 19.12' N
BF. BASE LINE 57.23' S
BF. BASE LINE 1095.52 E
W.P. EL. 584'-9½
MICROFILM SCALE
3" ON ORIGINAL
0
1
2
3
L. K. Comstock Engineering Co., Inc.
5350150
536-4357
RELE
CONS
F.J.
536-
A

PLAN


000
66'-0
℄ BLAST FCE. # 8
300.00S
145.50 E
145'-6
MATCH LINE BELOW
℄ BLAST FCE. # 8 ℄ CONV. BFCS-2
1'-8
℄ HEAD PULLEY
G
J-132927
500 S
250 S
723'-4¾
799'-10¼"
200'-0
180'-0
℄ HD. PULLEY
20'-0
100'-0
50'-0
FUTURE PHASE II ℄ SINTER PILE
20'-0
FUTURE PHASE II ℄ MISC. PILES
FUTURE PHASE II ℄ RECLAIM HOPPER
25'-0
25'-0
119'-0
FUTURE PHASE II ℄ PELLET PILE
130'-0 DIA.
FUTURE PHASE II ℄ PELLET PILE
130'-0 DIA.
140'-0 DIA.
FUTURE PHASE II ℄ PELLET & SINTER PILES & CONV. GS-1
FUTURE PHASE II ℄ TUNNEL & CONV. GS-2 & GS-3
℄ FUTURE MISC. PILES PHASE II
40'-0
40'-0
120'-0
40'-0
40'-0
105'-0
35'-0
35'-0
30'-0
40'-0 DIA. (TYP.)
664.83N
78.16E
BL. EL. 697'-9¼ (GS-4)
BL. EL. 683'-0 (GS-3)
℄ P-1 & PELLET SILOS
℄ SINTER SILOS
℄ COKE SILOS
℄ M-1 & M-2 ℄ MISC. MATL. SILOS
℄ BFCS-1
EXIST. 30"⌀ WATER
C
D
J-132928
℄ SILOS
℄ CONVS.
644.96 N.
58.75 E.
COKE CONV. W.P. EL. 685'-0
602.83N
BL. EL. 683'-0
B
A
CONVEYED
℄ SILOS
176'-4
264'-4
11'-2
35'-6
35'-6
11'-2
35'-6
35'-6
35'-6
26'-2 (REF.)
500 N
750 N
1000 N
1250 N
PLAN

REFERENCE DWGS:

J-132937 UNLOADING STATION SECTION
J-132942 STOCKPILE ARRGT.
J-132928 MISC. MATERIAL SECTION
J-132927 FURNACE FEED CONV. ARRGT.
J-132945 FINES CONV. PLAN ARRGT. & SECT.
J-132934 UNLOADING STATION TO STORAGE SILOS
J-132933 FINES SILO GEN. ARRGT. (REF. M-4357306)

REV.	DATE	MADE / CHKD.	DESCRIPTION	FILM ROLL NO.
[illegible]	9-7-76	R-J-S / JKL	RELOCATED BAG HOUSE & ... CONV. [illegible] FOR CONSTRUCTION [illegible]	
[illegible]	6-8-76	JS / TRE	GENERAL	
[illegible]	3-30-76	DAE / [illegible]	GENERAL	
[illegible]	12-2-75	JJS / TRE	APPROVAL CHANGES	
[illegible]	11-5-75	DAS / TRE	CONTROL HOUSE DFCS-1, BH-1 MOVED CONV. [illegible]	
[illegible]	10/30/75	JS / FLO	REVISED & CHECKED	
[illegible]	9-30-75	WHIZ	GENERAL	
[illegible]	9-22-75	WHIZ	GENERAL	
1	9-18-75	WHIZ	GENERAL	

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BY F.J. [illegible] DATE 8-18-76
SPEC. NO. 536-4357-2040 ADD. A
INITIAL RELEASE NO. ______ DATE ______

BLAST FURNACE DIVISION
FIG. 4-2. BLAST FURNACE No. 8
MATERIAL HANDLING SYSTEM
PLAN ARRANGEMENT
FAIRFIELD WORKS

Design Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SAFETY APPROVAL	DATE
WHIZ	9-5-75	F.L.O.	10-30-76				

PROJECT NO.	SCALE	
000-4357	1"=50'-0	J-132920

B

Foundations--Four drill rigs for caissons, one backhoe, 2 1/2-cubic yard capacity bulldozer, 2 1/2-cubic yard capacity front-end loader, 60-ton capacity crawler crane, 50-ton capacity truck crane, offsite concrete batch plant, dump trucks of various sizes, roller compaction equipment, concrete delivery trucks of various capacities, and miscellaneous light trucks.

Structural--Four crawler cranes of various sizes up to 150 tons, two tower derricks of 150-ton capacity, two mobile truck cranes up to 65-ton capacity, straddle truck, and numerous trucks of various capacities.

Electrical and Piping--Various trucks, small cranes, welding machines by all contractors.

Energy--All fuels for the internal combustion equipment will be furnished by contractors from local sources. Electrical power for lighting and small tools will be supplied from existing plant sources. The remainder of special electric power requirements is anticipated to be furnished by contractors with their own generating facilities.

Materials--It is estimated that the following major materials will be used in this project: 44,000 cu yd of reinforced concrete and 16,000 tons of structural steel. Eighty-five percent of this material is expected to be delivered by rail. Potable water is to come from existing plant sources.

Work Force--It is anticipated that the peaking force required for this project will be approximately 1,200 workmen.

Safety--Construction will proceed under stringent safety procedures, either those of OSHA, or U. S. Steel's safety programs, whichever is more stringent. Accident records will be kept by the individual contractors. Any other records will be maintained by the Plant Safety Department.

Sanitary--Facilities for this project are to be portable chemical toilets as approved by the local health offices.

4.2. OPERATION

4.2.1. Resultant Changes

4.2.1.1. Process

The new blast furnace will require a different charge than is given the other blast furnaces. Blast furnace No. 8 will require iron ore pellets, sinter, coke and limestone. With start-up of No. 8, remaining furnaces 5, 6, and 7 will also receive a more refined material charge than they are presently receiving. Improved performance and reliability should result. A detailed net raw material demand list for Fairfield Works before and after break-in of the No. 8 blast furnace is presented in Table 4-1.

4.2.1.2. Energy Balance

An energy balance for the existing iron-making facilities at Fairfield Works, based on rates for the year 1976, is provided in Figure 4-3. Inspection of this figure reveals that a total of 16.57 MMBTU was required for each ton of iron produced. Implementation of blast furnace No. 8 and phasing out of 1, 2, and 3, will result in the energy requirements depicted in Figure 4-4. Analysis of this figure reveals that a total of 14.43 MMBTU will be required per ton of iron produced, a savings of 2.14 MMBTU per ton of iron produced.

4.2.1.3. Water Requirements

Water required for the blast furnace will be supplied from the Birmingham municipal water supply system and the Birmingham Industrial Water Board. No treatment is required of the water before entering the water systems associated with the blast furnace. The amount and sources of this increased water demand are outlined in Table 4-2.

TABLE 4-1

ANTICIPATED RAW MATERIAL DEMAND CHANGES
WITH BLAST FURNACE NO. 8

Material Produced or Required	FCE No.1	FCE No.2	FCE No.3	Total Ensley	FCE No.5	FCE No.6	FCE No. 7	Total Fairfield	Total Blast FCES	Before No.8 Completed (Ingot Tons/ Year)	FCE No.5	FCE No.6	FCE No.7	FCE No.8	Total Blast FCE	After No.8 Completed (Ingot Tons/ Year)
Iron Ore Required																
Crude	478,000	478,000	477,000	1,433,000	--	--	--	--	1,443,000	1,433,000	--	--	--	--	--	0
Coarse	65,000	65,000	66,000	196,000	296,000	306,000	402,000	1,004,000	1,200,000	1,200,000	145,000	195,000	260,000	--	600,000	600,000
Sinter (Fine)	143,000	143,000	143,000	429,000	610,000	632,000	829,000	2,071,000	2,500,000	2,500,000	335,000	449,000	599,000	1,117,000	2,500,000	2,500,000
Pellets	--	--	--	--	--	--	--	--	--	0	171,000	229,000	305,000	1,675,000	2,380,000	2,380,000
										5,133,000						5,480,000
Coke Required	217,000	217,000	217,000	651,000	343,000	355,000	466,000	1,164,000	1,815,000	1,815,000	236,000	316,000	435,000	963,000	1,950,000	1,950,000
Limestone	37,000	36,000	36,000	109,000	55,000	57,000	75,000	187,000	296,000	296,000	28,000	38,000	54,000	134,000	254,000	318,000
Dolomite	16,000	17,000	16,000	49,000	--	--	--		49,000	449,000	--	--	--	--	--	395,000
Total Stone										745,000						713,000
Blast Furnace																
Fairfield 5,6,7										187,000						120,000
Fairfield 8										0						134,000
Ensley 1,2,3										158,000						0
Sinter Plant										400,000						459,000
										745,000						713,000
Sinter Required										2,500,000						2,500,000
Hot Metal Produced										2,900,000						3,500,000

TABLE 4-2

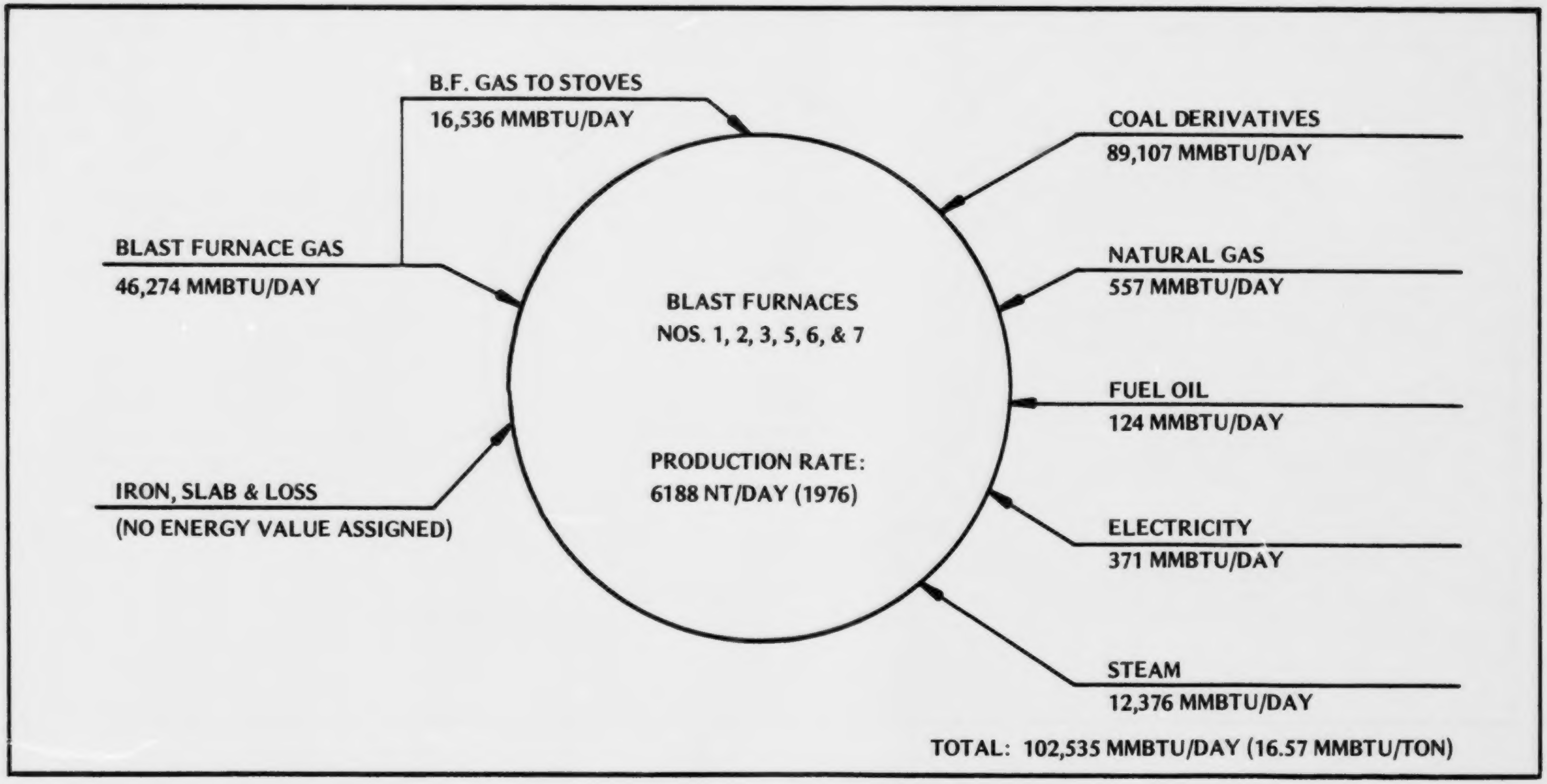
ADDITIONAL INDUSTRIAL WATER REQUIREMENTS[a] NO. 8 BLAST FURNACE, FAIRFIELD WORKS

User	Normal		Peak	
	gpm	gpd	gpm	gpd
Blast Furnace				
Make-up to Gas Cleaning System	800	1,152,000	1,100	1,584,000
Strainer Backwash	0	0	500	720,000
Strainer Backwash	0	0	300	432,000
Cooling Tower Make-up	320	460,800	320	460,800
Running Blast Furnace Gas Seals	300	432,000	300	432,000
	1,420	2,044,800	2,520	3,628,800
Boiler House				
Boiler Feed-water Make-up	1,150	1,656,000	2,800[b]	1,800,000[c]
Cooling Tower Make-up	600	864,000	660	950,400
	3,170	4,564,800	5,980[b]	6,379,200[c]

[a] City of Birmingham Industrial Water Board

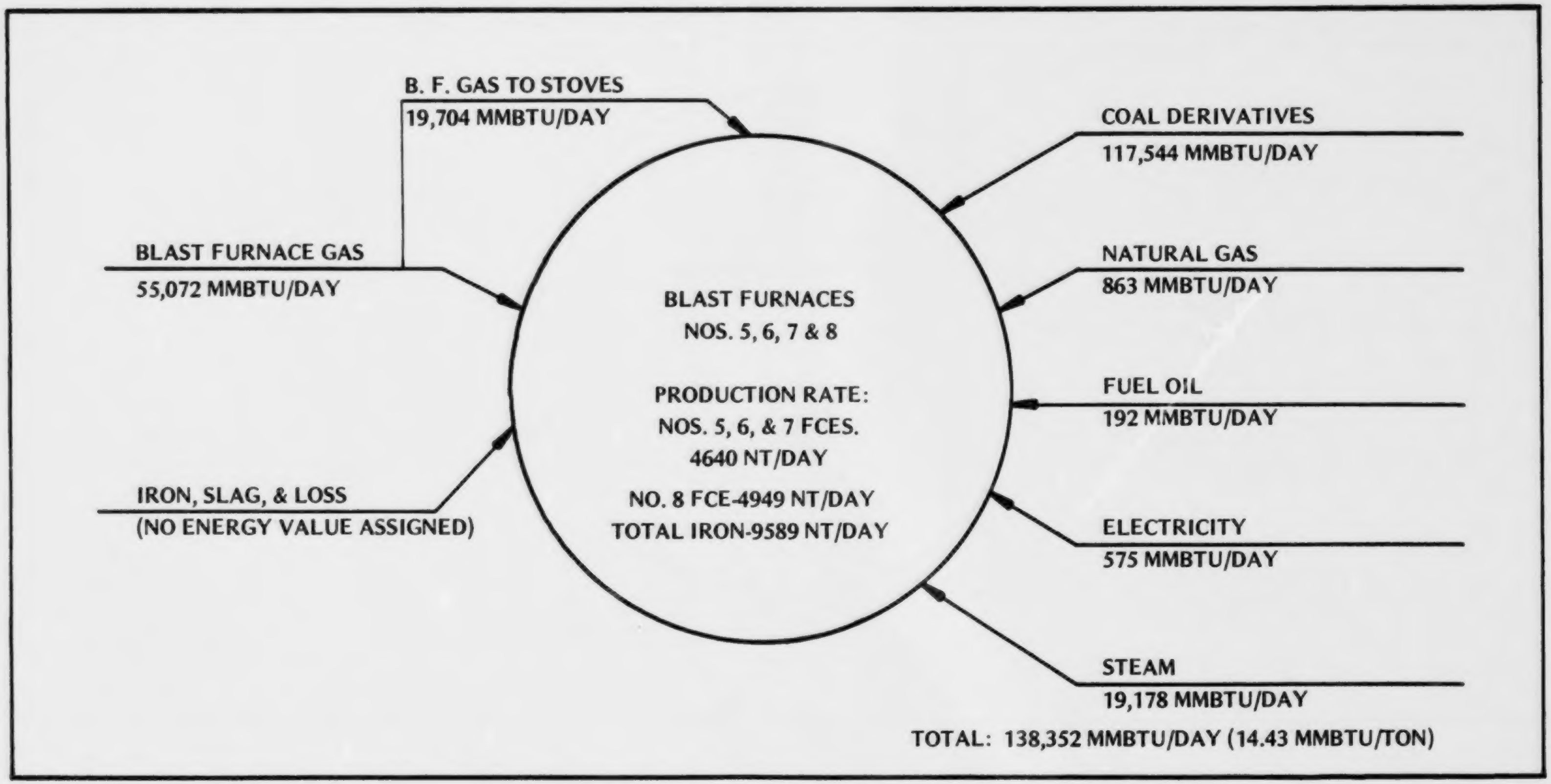
[b] Short Duration Peak

[c] Day Peak


B.F. GAS TO STOVES
16,536 MMBTU/DAY
BLAST FURNACE GAS
46,274 MMBTU/DAY
IRON, SLAB & LOSS
(NO ENERGY VALUE ASSIGNED)
BLAST FURNACES
NOS. 1, 2, 3, 5, 6, & 7
PRODUCTION RATE:
6188 NT/DAY (1976)
COAL DERIVATIVES
89,107 MMBTU/DAY
NATURAL GAS
557 MMBTU/DAY
FUEL OIL
124 MMBTU/DAY
ELECTRICITY
371 MMBTU/DAY
STEAM
12,376 MMBTU/DAY
TOTAL: 102,535 MMBTU/DAY (16.57 MMBTU/TON)

ENERGY BALANCE

FIG. 4-3. IRONMAKING - FAIRFIELD WORKS


B. F. GAS TO STOVES
19,704 MMBTU/DAY
BLAST FURNACE GAS
55,072 MMBTU/DAY
IRON, SLAG, & LOSS
(NO ENERGY VALUE ASSIGNED)
BLAST FURNACES
NOS. 5, 6, 7 & 8
PRODUCTION RATE:
NOS. 5, 6, & 7 FCES.
4640 NT/DAY
NO. 8 FCE-4949 NT/DAY
TOTAL IRON-9589 NT/DAY
COAL DERIVATIVES
117,544 MMBTU/DAY
NATURAL GAS
863 MMBTU/DAY
FUEL OIL
192 MMBTU/DAY
ELECTRICITY
575 MMBTU/DAY
STEAM
19,178 MMBTU/DAY
TOTAL: 138,352 MMBTU/DAY (14.43 MMBTU/TON)

ENERGY BALANCE

FIG. 4-4. IRONMAKING – FAIRFIELD WORKS

4.2.1.3. Employment

Manpower changes in operations at Ensley and at Fairfield will result from the break-in and operation of blast furnace No. 8, as well as from the subsequent idling of Ensley blast furnaces 1, 2, and 3. The base period before the break-in will have three operating blast furnaces each at Fairfield and at Ensley. The break-in period will have four operating furnaces at Fairfield and three at Ensley. This period will require an incremental increase of 259 employees at Fairfield Works. Subsequently, three Ensley furnaces will be idled, causing a reduction in work force with each furnace idling. Idling of the three furnaces will reduce the operating work force by 45, then 68, and 168, sequentially. The net reduction in Fairfield Works caused by modernization of the blast furnace operations will then be 22 positions at the blast furnace.

4.2.2. Process Description

A blast furnace is a circular shell of steel about 130 ft high, which is lined with heat resistant fire brick. The new blast furnace will use a different top charging procedure than the existing Fairfield blast furnaces. It will have a greater capacity, require a more refined material burden, and operate at a higher internal pressure.

4.2.2.1. Material Handling

Materials for smelting are stored in the stockhouse. These materials are loaded onto the charging conveyor from another conveyor system which is loaded from the silos in the stockhouse. The conveyor belt traveling to the furnace top pours its contents into a receiving hopper.

4.2.2.2. Charging the Furnace

Once the burden material is weighed, the material is dumped onto a 60-in. collector belt, and taken at a rate of 342 fpm to the furnace top by the main charging belt. At the top of the furnace, the material is charged through a series of hoppers and their associated seal valves onto a revolving chute which discharges the burden into the furnace.

The top of the furnace is designed to operate from 0 to 30 psig top pressure. The system, Figure 4-5, contains a twin hopper arrangement. Each hopper can be pressurized to 30 psig.

The key features of the furnace top are two lockhoppers equipped with flap valves, material flow control valves, a single central discharge into the furnace, a rotating chute which is adjustable in slope from outside the furnace and the design for replacement of any major component in 16 hours.

Burden materials are charged into the furnace through its top by alternately opening and closing the seal valves above and below each lockhopper. To accomplish this and to prevent the escape of gas to the atmosphere, it is necessary that each lockhopper be alternately pressurized and depressurized. Pressurization of each lockhopper is accomplished with nitrogen. This eliminates emissions from the top.

Nitrogen required to pressurize the two lockhoppers is produced at the air separation plant. This nitrogen is discharged to the atmosphere when a hopper is depressurized.

As the batch of material is discharged, additional nitrogen can be forced into the lockhoppers to replace the volume of the materials emptied. Then, when the lockhopper is depressurized to receive the next batch, principally nitrogen is emitted.

The rotating chute can be used to charge raw material to any portion of the furnace throat area, including what used to be "the shadow of the bell." Spiral charging will be used.

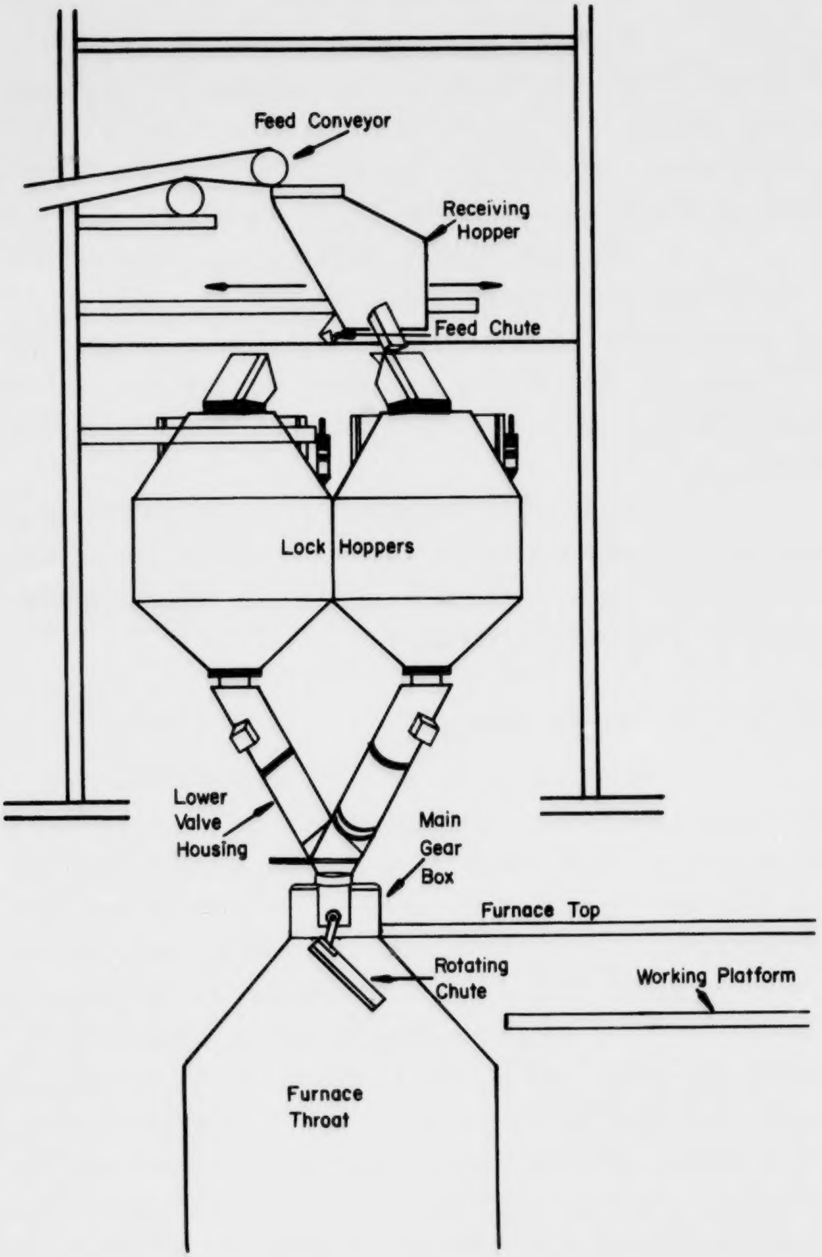

Feed Conveyor
Receiving Hopper
Feed Chute
Lock Hoppers
Lower Valve Housing
Main Gear Box
Furnace Top
Rotating Chute
Working Platform
Furnace Throat

FIG. 4-5. TWIN HOPPER SYSTEM OF CHARGING FOR BLAST FURNACE NUMBER 8

Typically, the revolving chute will rotate at 8 rpm, driven by a 600/1,800-rpm motor. The relation of lockhopper size and flow control gate opening is such that a discharge time of 90 sec is obtained and material is distributed into the furnace during the corresponding 12 revolutions of the chute.

The spiral layers of coke, ore, and limestone placed in the furnace in accurately measured quantities will insure that iron of the desired chemical analysis will be produced. Charging, or filling, the furnace is a continuous process, more materials being added as those within the furnace melt and flow into the hearth, or bottom.

A gas analyzing probe capable of extending to and receiving gas samples from the center of the furnace or any of nine other positions back to the wall will aid in determining maximum gas utilization and burden distribution.

4.2.2.3. Hot Air Supply

Adjacent to the blast furnace will be three cylindrical shells with dome-shaped tops. These will be the hot blast stoves. The function of these stoves is to furnish extremely hot air to the furnace to aid combustion of the coke. Within the hot blast stove is a labyrinth of fire bricks called checkers. Gas from the blast furnaces is burned in the combustion chamber of the stoves until the bricks in the stove dome have been heated to a temperature of 2300°F. Then the gas is cut off and air is blown through the stove, where it absorbs heat from the checkers, and then into the bottom of the blast furnace through openings called tuyeres. This continues until the temperature of the checkers has been reduced to a point where the desired hot blast temperature can no longer be delivered, then the cycle is repeated. The stoves are operated alternately, one stove furnishing a supply of hot air to the furnace while the others are being heated. Heated air, at the rate of 210,000 cu ft of air per min, will be blown into the blast furnace.

4.2.2.4. Furnace Operation

The coke burns continuously, and its burning will be greatly intensified by the heated air from the stove, blown in at temperatures of 2100°F. The iron will sink gradually toward the bottom of the furnace as the material beneath it melts away. The heat greatly increases toward the bottom, where air makes contact with the coke. The iron and limestone melt and trickle through the flaming coke to the hearth, which is a cylindrical receptacle at the base of the furnace.

The silica and certain other impurities in the melted iron ore are absorbed by the molten limestone. This forms a slag which is lighter than the molten iron and floats on the pool of liquid metal. Every several hours a hole known as the "iron notch" is opened in the hearth and the hot iron is allowed to flow out and down a ceramic-lined trough. From the trough it flows into a sand-lined runner, and from the runner into an insulated container referred to as a "submarine" ladle. This drainage process is called "casting."

The flux and impurities are withdrawn in the form of slag. These materials are separated from the iron by the casting operation and diverted to the slag pits for cooling and subsequent removal to a slag dump.

Nearly all of the iron produced at Fairfield Works is used in the making of steel. Iron for this purpose is transferred to the Q-BOP department where it is poured into huge cauldrons, or hot metal mixers. There it is held in a molten state until needed for charging into the Q-BOP furnaces. A portion of the hot iron is used at the foundry to produce ingot molds. Some of the iron may be moved to the pig casting machine at the ladle house where it is poured from a ladle into two parallel, endless chains of pig molds. As the molds move slowly upward and outward, the metal hardens into solid blocks of "pigs." The "pigs" are cooled by water sprays, and discharged into railroad cars.

4.2.3. Design Summary

1. 32-ft diameter
2. 26 tuyeres, 2 compartment tuyeres (separate nose cooling)
3. 30 psi high top pressure (maximum)
4. 77,520 cu ft working volume
5. Ratio working volume to sq ft of hearth is 96.4
6. Three stoves (total heating surface 1,993,600 sq ft)
7. 2100°F hot blast--Bloom stove burners
8. Mohr-Raco hot blast valves with automatic stove changing controls
9. 210,000 cfm @ 60 psi wind max
10. One Ingersoll-Rand axial turbo blower
11. Two 900-psi steam pressure boilers (Combustion Engineers' type)
12. Two iron notches (with provisions to remove trough)
13. Two 75-ton casthouse cranes (one 15-ton cinder running crane)
14. One cinder notch
15. Two slag pits
16. Bailey-Wurth mud guns--Woodings low profile iron notch drills
17. 5,000 tons per day (6,000 tons peak hot metal) capacity
18. Six 250-ton submarine-type hot metal cars
19. 1,100 lb/NTHM coke equivalent
20. 150 lb/NTHM flux
21. Liquid fuel injection (No. 6 fuel oil)
22. Burden mix--60 percent pellets, 40 percent sinter
23. Pellets, sinter and coke to be screened
24. Conveyor charged furnace (60 in. belt to top speed 342 fpm)

25. Cutler hammer charging control system (two directors for furnace operation linked to Honeywell 4400 computer at the Q-BOP for monitoring furnace operation)
26. Stockhouse capacity (coke, 13.5 hr; sinter, 22.5 hr; pellets, 29.8 hr; miscellaneous material, 30.0 hr)
27. Stockhouse has three coke, two sinter, two pellet, four miscellaneous and two fines monolithic concrete silos
28. Koppers-Wurth-type top "no bells" (nitrogen purge), one 30-ton crane for servicing top
29. BAUMCO gas cleaning system with closed water system (Venturi type without septum valve)--both contact and non-contact water systems are recycled
30. Channel cool externally bosh and hearth
31. Underhearth is water cooled

4.2.4. Operational Parameters

Raw Materials Required	
Coke	950,000 tons/yr
Sinter	1,125,000 tons/yr
Pellets	1,700,000 tons/yr
Flux (Limestone)	130,000 tons/yr
Products	
Iron	1,825,000 tons/yr
Slag	600 lb/ton hot metal
Blast Furnace Gas	110×10^9 ACF

4.3. WASTE GENERATION

4.3.1. Gas Cleaning

As the air strikes the burning coke, the fuel gives off hot carbon monoxide gas which rises through the furnace, reacting on the layers of ore and removing much of the oxygen. The gas thus formed is highly combustible and is suitable for use as fuel. It is collected at the top of the furnace and is forced out through pipes called "uptakes."

After cleaning, part of the gas is piped to the hot blast stoves to continue the heating process, maintaining a continuous cycle of heat from stove to blast furnace back to stove. The remainder of the gas is burned in steam boilers to produce power for the blowers which force air into the furnace. This gas is also used to turn generators, producing electrical current that assists operation of some of Fairfield's mills.

The maximum expected volume of gas produced by No. 8 blast furnace is 300,000 standard cu ft per min (scfm). This gas will contain approximately six grains of dust per cu ft. On this basis, the total quantity of dust leaving the top of the furnace is 188 tons per day.

The generated blast furnace gas will be taken off the top of the furnace through four large uptakes which connect to form one downcomer to the dustcatcher. Gas will enter the top of the dustcatcher and travel down a cone in the center of the tank. As the gas passes through the cone, it will be decelerated upon entering the bottom part of the tank. The heavier dust particles will maintain their velocity and will be driven to the bottom of the dustcatcher as the gas exits and is piped to the Venturi scrubbers.

With an efficiency of approximately 33 1/3 percent, some 62 tons of dust are removed from the gas and collected in the bottom of the dustcatcher for periodic removal. Removal of dust from the dustcatcher is accomplished by opening a system of valves to permit discharge through a pug mill. Available water and/or steam is injected into the pug mill to prevent dusting when discharged into a truck. This material will then be delivered by truck to the sinter plant for recycling.

The gas, now containing approximately four grains per cu ft, will pass from the dustcatcher to adjustable-throat Venturi scrubbers, having a minimum efficiency of 99.87 percent for final cleaning. Here the velocity of the gas is significantly increased by passing through a throat restriction in which water sprays are located. The high velocity gas atomizes the water which entrains the dust particles, thus removing the dust particles from the gas stream. The maximum dust content of the cleaned gas is now 0.005 grains per cu ft.

The blast furnace gas at this point will have been so thoroughly cleaned that it can be reused directly in the stoves of No. 8. Only part of the gas is used in the stoves, the remainder being piped to the boilerhouse. The system will maintain a constant gas back pressure of 85 in. H_2O for the No. 8 blast furnace stoves and release the balance, a pressure of 20 in. H_2O to the boilerhouse. Any excess gas will be burned in a stack at the boiler-turbo-blower building.

The separator-cooler functions as two separate systems. The gas and dirty water enter the tank. The dirty water immediately separates and is gravity fed to the classifier and then to the thickeners. The gas goes through a spin vane where it exits to the upper portion of the tank. The gas will be cooled to a maximum 100°F.

The slurry mixture of dust and water is collected for passage into the recirculated, enclosed waste water treatment system. The water treatment schematic for blast furnace No. 8 is presented in Figure 4-6. The slurry flows to a spiral classifier which removes some of the larger solids and silt. This material is recycled to the furnace through the sinter plant, as is dust from the dustcatcher.

The slurry flow is then normally equally split to one of two 80-ft diameter thickeners. Thickeners are circular reinforced concrete tanks. Dirty water enters at the center of the thickeners and clarifier effluent leaves over a continuous weir which follows the tank circumference. Rotating arms carry a series of rakes set at an angle such that the solids are settled and gently pushed toward the center of the thickener. Thickener underflow is pumped to one of two vacuum filters which filter the sludge and produce a filter cake. This material is also recycled by sending it through the sinter plant.

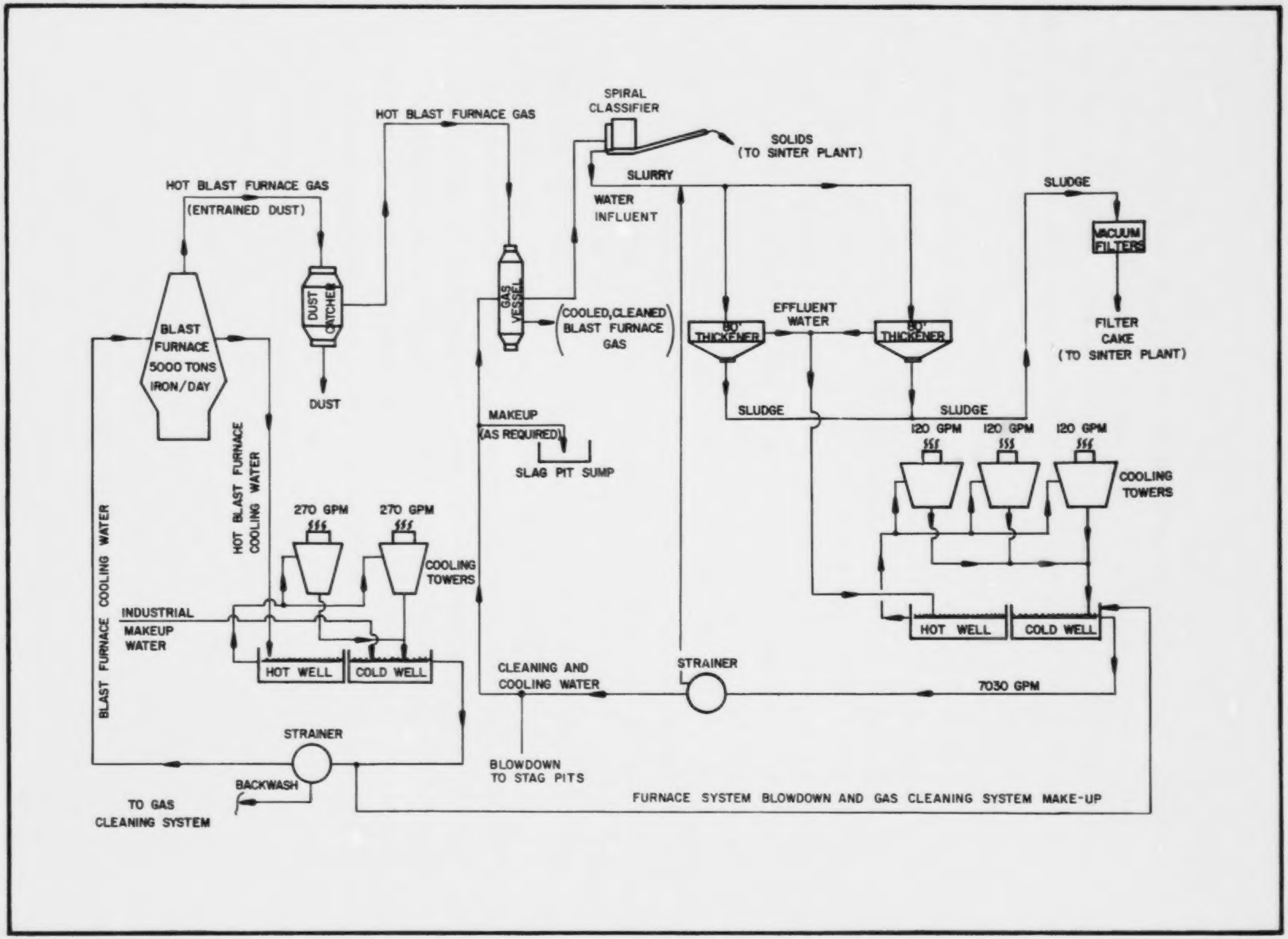

HOT BLAST FURNACE GAS
HOT BLAST FURNACE GAS
(ENTRAINED DUST)
SPIRAL CLASSIFIER
SOLIDS (TO SINTER PLANT)
SLURRY
WATER INFLUENT
SLUDGE
VACUUM FILTERS
FILTER CAKE (TO SINTER PLANT)
BLAST FURNACE 5000 TONS IRON/DAY
DUST CATCHER
DUST
GAS VESSEL
(COOLED, CLEANED BLAST FURNACE GAS)
EFFLUENT WATER
80' THICKENER
80' THICKENER
SLUDGE
SLUDGE
MAKEUP (AS REQUIRED)
SLAG PIT SUMP
120 GPM
120 GPM
120 GPM
COOLING TOWERS
HOT BLAST FURNACE COOLING WATER
BLAST FURNACE COOLING WATER
270 GPM
270 GPM
COOLING TOWERS
INDUSTRIAL MAKEUP WATER
HOT WELL
COLD WELL
HOT WELL
COLD WELL
CLEANING AND COOLING WATER
STRAINER
7030 GPM
STRAINER
BACKWASH
TO GAS CLEANING SYSTEM
BLOWDOWN TO STAG PITS
FURNACE SYSTEM BLOWDOWN AND GAS CLEANING SYSTEM MAKE-UP

FIG. 4-6. WATER TREATMENT FLOW DIAGRAM FOR NUMBER 8 BLAST FURNACE

Cationic polymer addition at a concentration of 5 ppm and anionic polymer feed of approximately one ppm concentration will assist in producing a satisfactory effluent by acting as a coagulant.

The effluent water, still at an elevated temperature, is discharged into the hot well. The flow then passes through one of three cooling towers which achieves the desired temperature reduction.

The cooled effluent water will now be of such a nature that it can be successfully reintroduced to the gas cleaning and cooling equipment. Prior to entering the scrubber, a portion will be diverted from the system to serve as make-up for the slag pit sump.

Blowdown will be utilized to quench the blast furnace slag. A major portion of this water evaporates in quenching with the remainder filtering through the slag for collection and recycle in the slag pit quench system. Blowdown from the gas cleaning system is expected to be as much as 0.65 mgd.

4.3.2. Casthouse Emissions

Based on information provided by the U. S. Steel Corporation, no basic iron casthouses in the United States have air emission controls. No casthouse emission controls are planned for the new blast furnace at Fairfield Works.

4.3.3. Cooling

Due to the very high temperatures obtained in operating the blast furnace, a large amount of cooling water is required. This is recirculated through the independent furnace cooling system.

Encircling the furnace are water troughs into which water supplying the numerous cooling circuits is discharged as visible streams. Water flows from these troughs into a hot well. The water is then pumped to one of two evaporative cooling towers where the desired temperature reduction is achieved. Water from these cooling towers is collected in a cold well. All required make-up water for both waste treatment and furnace cooling water systems may effectively be added at this point. Blowdown from cooling will be employed as make-up to the gas cleaning water system. This system blowdown will also be accomplished prior to and in conjunction with strainer operation. The water will then be reintroduced into the numerous cooling circuits encompassing the furnace shell. Blowdown will go first to other treatment facilities for cooling and then to the final effluent control pond before eventual discharge to Little Creek, which enters Opossum Creek.

The furnace stack will be cooled by circulating water through stack plates which are imbedded in the brickwork of the furnace. There are 26 rows of stack plates offering cooling up to 11 ft, 6 in. beneath the stockline. The bosh and hearth will have external channel coolers. In the area of the two iron notches, outside jackets and internal staves will provide the cooling. External channel coolers also will be used at the tuyeres level around the 26 water-cooled tuyeres and corresponding tuyere coolers. Under-hearth cooling will be accomplished by collecting water from the stack system and gravity feeding it through twenty, 3-in. stainless steel pipes imbedded in the bottom course of the carbon block hearth. A cinder notch will be available at the north side of the hearth if it is needed. For normal operations the cinder notch will be covered.

The water pumped from the furnace coldwell sump will be used in the stack plates. Stove valves, tuyere noses, and tuyere cooler water from the stove valves and tuyere noses is pumped back to the bosh channels and tuyere jackets before it goes to the hotwell sump. Stack cooling system discharge will be collected and run through the upper hearth, lower hearth, and underhearth cooling which discharges back to the hotwell sump. Because of the large volume of water pumped through this system, the water is expected to pick up about 20°F of temperature in the entire cycle. Industrial make-up water will be automatically added to the furnace coldwell sump as required.

4.3.4. Slippages or Service Requirements

On infrequent occasions a large mass of burden material within the furnace will descent rapidly, creating a sudden increase in internal furnace pressure. To prevent damage to furnace top equipment, bleeder valves are positioned near the junction of the four uptakes and the downcomer and are located 280 ft above grade. These valves are safety valves for emergency use only and are designed to automatically and sequentially open at varying pressures to relieve excessive furnace pressure by discharging furnace gas to the atmosphere (see Figure 4-7). The time interval during which these valves are open is usually of short duration. The slips that will occur in the new blast furnace will be greatly reduced in frequency of occurrence. Slip frequency should occur on a monthly recurrence.

4.3.5. Material Handling

The burden to be charged into No. 8 blast furnace includes iron-bearing material, coke, and flux material. Iron-bearing material will consist of iron ore pellets and sinter. Flux material will include gravel, dolomite, and limestone.

All burden materials will be delivered to the furnace complex by railroad car and transferred to the stockhouse storage silos by conveyor systems. Coke will be transmitted directly from the coke battery to the stockhouse silos by conveyors.

Pellets, coke, sinter, and flux will be withdrawn from the stockhouse silos by vibrating pan feeders and placed on belt conveyors. Pellets, coke, and sinter will be screened as the material comes from the respective belt conveyors and deposited into weight hoppers. The weight hoppers will discharge directly onto another conveyor. Coke will be screened to remove minus 1/8-in material. Minus 1/4-in material will be removed from the pellets and sinter. Conveyors will transfer these materials to storage silos. The flow diagram for this facility is shown in Figure 4-8.

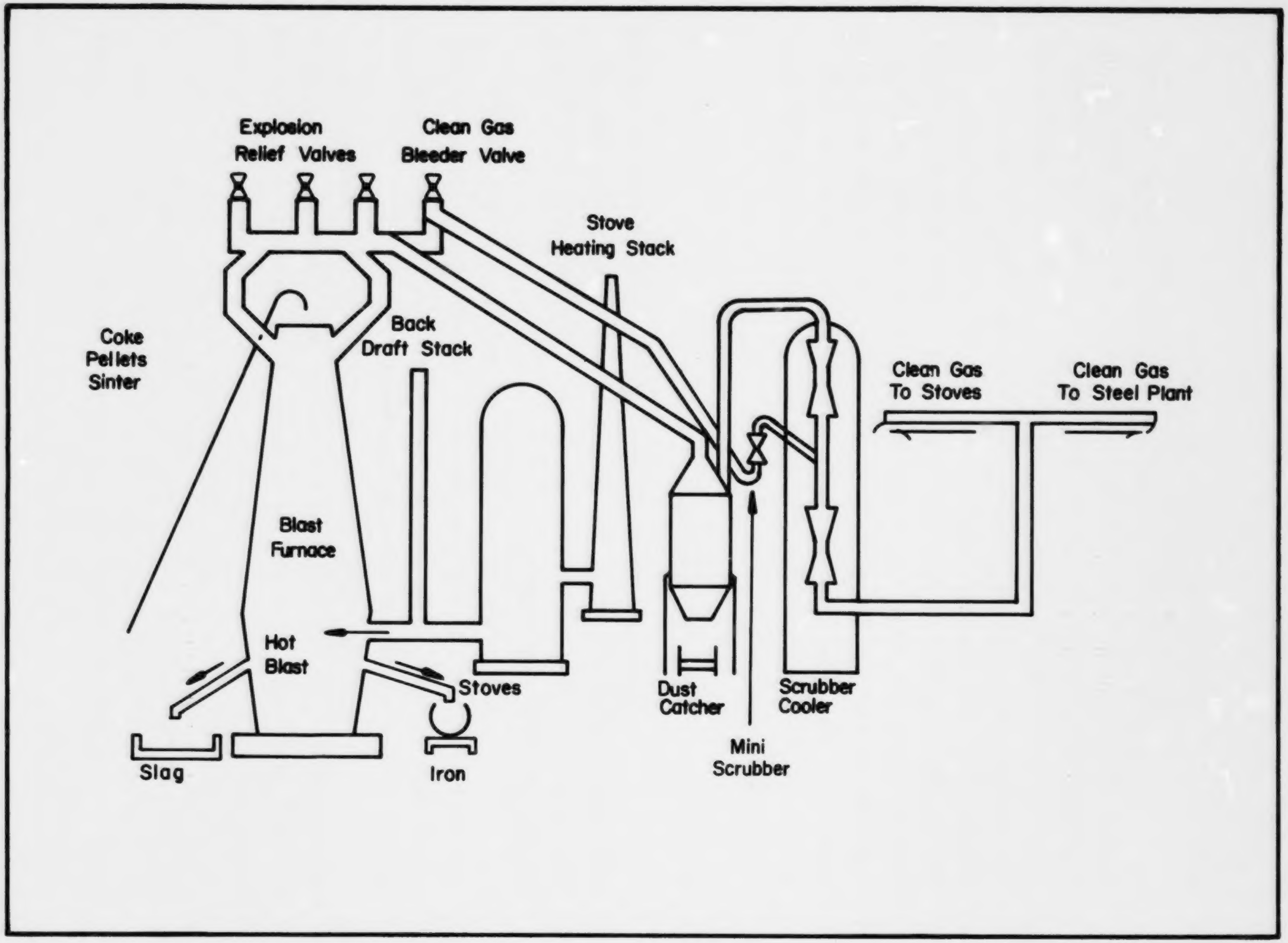

Explosion
Relief Valves
Clean Gas
Bleeder Valve
Stove
Heating Stack
Coke
Pellets
Sinter
Back
Draft Stack
Clean Gas
To Stoves
Clean Gas
To Steel Plant
Blast
Furnace
Hot
Blast
Stoves
Slag
Iron
Dust
Catcher
Scrubber
Cooler
Mini
Scrubber

FIG. 4-7. GAS CLEANING SYSTEM FOR BLAST FURNACE NUMBER 8

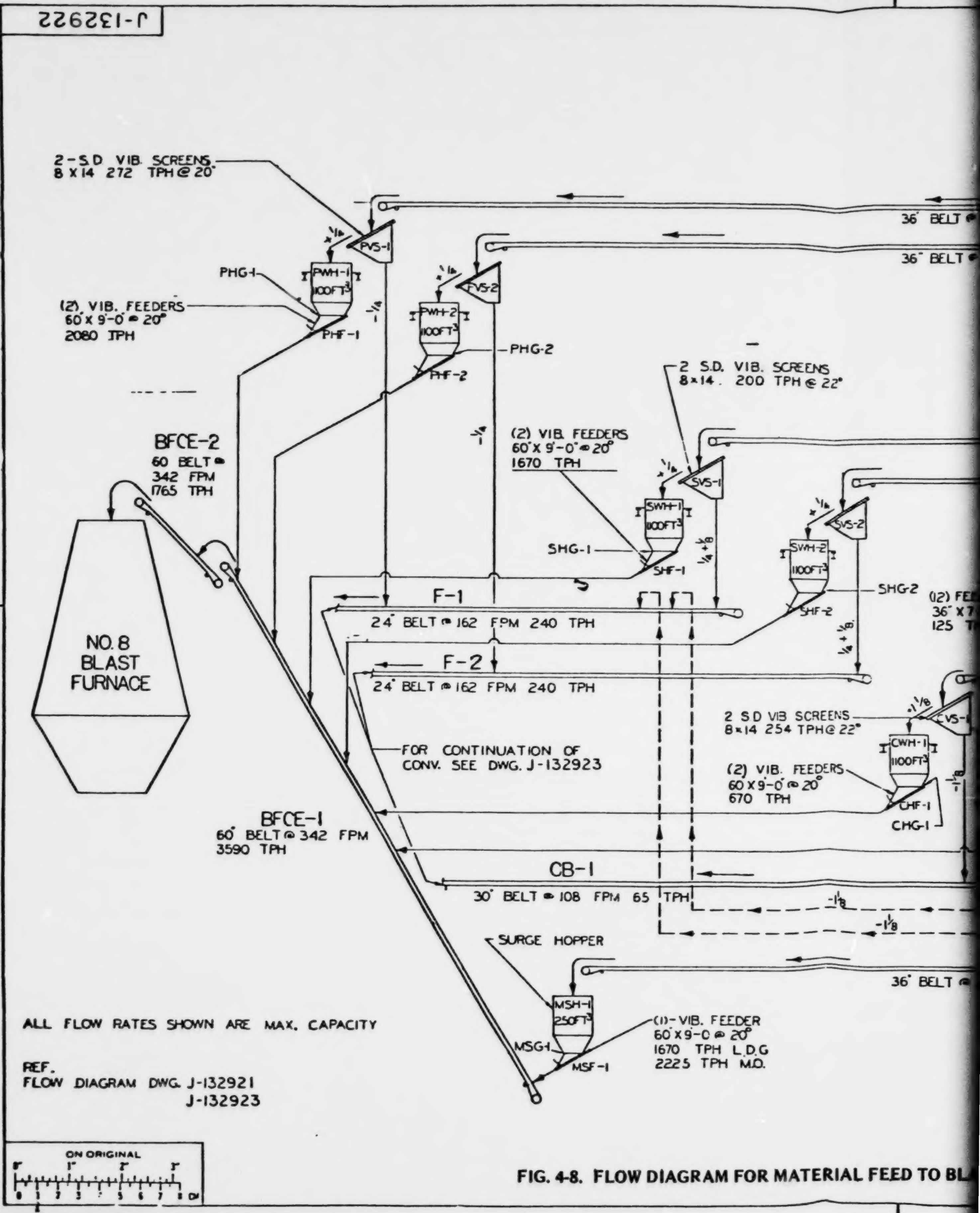
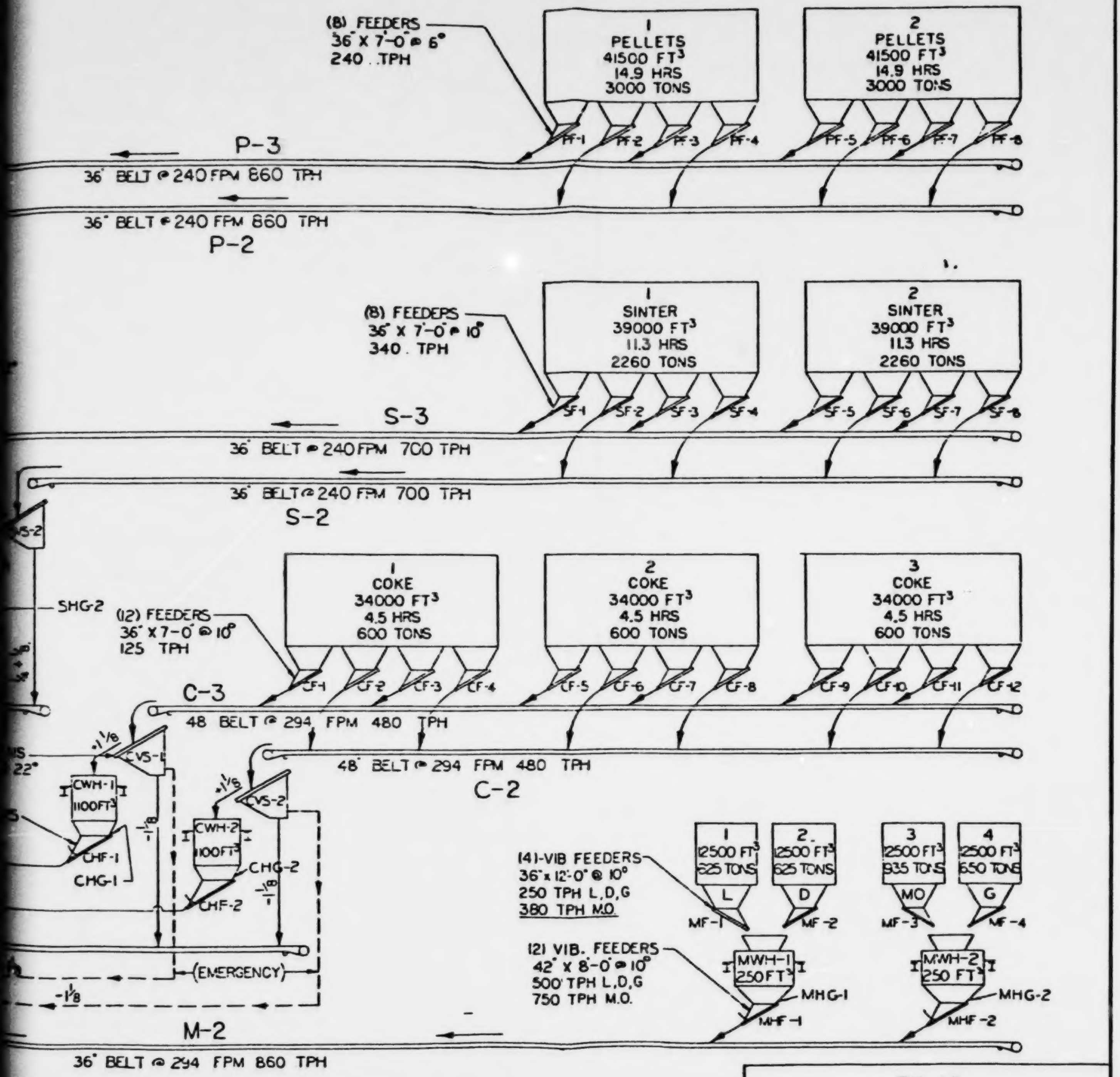

J-132922
2-S.D VIB. SCREENS
8 X 14 272 TPH @ 20°
36" BELT
36" BELT
PVS-1
PVS-2
PHG-1
PWH-1
1100FT³
PWH-2
1100FT³
(2) VIB. FEEDERS
60" X 9'-0" @ 20°
2080 TPH
PHF-1
PHF-2
PHG-2
-1¼
-1¼
2 S.D. VIB. SCREENS
8 x 14 . 200 TPH @ 22°
BFCE-2
60 BELT @
342 FPM
1765 TPH
(2) VIB. FEEDERS
60" X 9'-0" @ 20°
1670 TPH
SVS-1
SVS-2
SWH-1
1100FT³
SWH-2
1100FT³
SHG-1
SHF-1
SHF-2
SHG-2
-1¼ +⅛
-1¼ +⅛
(12) FE
36" X 7
125 T
NO. 8
BLAST
FURNACE
F-1
24" BELT @ 162 FPM 240 TPH
F-2
24" BELT @ 162 FPM 240 TPH
2 S D VIB SCREENS
8 x 14 254 TPH @ 22°
CVS-1
CWH-1
1100FT³
(2) VIB. FEEDERS
60 X 9'-0" @ 20°
670 TPH
CHF-1
CHG-1
-1⅛
FOR CONTINUATION OF
CONV. SEE DWG. J-132923
BFCE-1
60" BELT @ 342 FPM
3590 TPH
CB-1
30" BELT @ 108 FPM 65 TPH
-1⅛
-1⅛
SURGE HOPPER
36" BELT @
MSH-1
250FT³
MSG-1
MSF-1
(1)-VIB. FEEDER
60 X 9'-0 @ 20°
1670 TPH L.D.G
2225 TPH M.D.
ALL FLOW RATES SHOWN ARE MAX. CAPACITY
REF.
FLOW DIAGRAM DWG. J-132921
J-132923
A
ON ORIGINAL
0" 1" 2" 3"
0 1 2 3 4 5 6 7 8

FIG. 4-8. FLOW DIAGRAM FOR MATERIAL FEED TO BL


(8) FEEDERS
36" X 7'-0" @ 6°
240 TPH
1
PELLETS
41500 FT³
14.9 HRS
3000 TONS
2
PELLETS
41500 FT³
14.9 HRS
3000 TONS
PF-1
PF-2
PF-3
PF-4
PF-5
PF-6
PF-7
PF-8
P-3
36" BELT @ 240 FPM 860 TPH
36" BELT @ 240 FPM 860 TPH
P-2
(8) FEEDERS
36" X 7'-0" @ 10°
340 TPH
1
SINTER
39000 FT³
11.3 HRS
2260 TONS
2
SINTER
39000 FT³
11.3 HRS
2260 TONS
SF-1
SF-2
SF-3
SF-4
SF-5
SF-6
SF-7
SF-8
S-3
36" BELT @ 240 FPM 700 TPH
36" BELT @ 240 FPM 700 TPH
S-2
VS-2
SHG-2
(12) FEEDERS
36" X 7'-0" @ 10°
125 TPH
1
COKE
34000 FT³
4.5 HRS
600 TONS
2
COKE
34000 FT³
4.5 HRS
600 TONS
3
COKE
34000 FT³
4.5 HRS
600 TONS
CF-1
CF-2
CF-3
CF-4
CF-5
CF-6
CF-7
CF-8
CF-9
CF-10
CF-11
CF-12
C-3
48" BELT @ 294 FPM 480 TPH
48" BELT @ 294 FPM 480 TPH
C-2
22°
-1⅛
CVS-1
CWH-1
1100FT³
CHF-1
CHG-1
-1⅛
CVS-2
CWH-2
1100FT³
CHG-2
CHF-2
-1⅛
(EMERGENCY)
-1⅛
(4)-VIB FEEDERS
36" x 12'-0" @ 10°
250 TPH L,D,G
380 TPH M.O.
1
12500 FT³
625 TONS
L
2
12500 FT³
625 TONS
D
3
12500 FT³
935 TONS
MO
4
12500 FT³
650 TONS
G
MF-1
MF-2
MF-3
MF-4
(2) VIB. FEEDERS
42" X 8'-0" @ 10°
500 TPH L,D,G
750 TPH M.O.
MWH-1
250FT³
MHG-1
MHF-1
MWH-2
250 FT³
MHG-2
MHF-2
M-2
36" BELT @ 294 FPM 860 TPH

Design Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

RELEASED FOR CONSTRUCTION

BY [illegible] DATE 8-19-76

SPEC NO 530-4357-2040 ADD —

INITIAL RELEASE NO ______ DATE ______

FOR DESIGN REFERENCE ONLY △

AL FEED TO BLAST FURNACE NO. 8

10	5-7-76	JAF	JKL		[illegible]
9	5-28-76	M.D.	[illegible]		[illegible]
8	12-29-75	M.M.	[illegible]		
7	12-3-75	MAB	[illegible]		
6	10-27-75	F.S.			
5	10-21-75	MD			
4	10-9-75	MAD			
3	9-26-75	MD			[illegible]
△2	9-16-75	M.M			
1	9-11-75	MD			
0	✕	✕	✕	✕	
REV	DATE	BY	[illegible]	[illegible]	[illegible]

FIG. 4-8
BLAST FURNACE NO. 8
FAIRFIELD WORKS

Design Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

[illegible]	DATE	[illegible]	DATE	[illegible]	DATE	[illegible]	DATE
MD	12-6-75						
PROJECT NO		SCALE		J-132922			
530-4357		NTS					

B

A dust collection system will be utilized to collect dust that is generated when pellets, coke, and sinter are screened. The system consists of dry collection baghouse units in the stockhouse which are connected by ducts to hoods positioned over each screen. The production rates for each of the two pellet, coke, and sinter screens in the stockhouse are approximately 272, 254, and 200 tons per hr, respectively, of screened material. Exhaust air is provided by fans which are positioned downstream of the baghouses. These units have an estimated efficiency of 99.9 percent. The collection units in the stockhouse are capable of handling an estimated 25,000 standard cu ft of dust laden air per minute. Cleaned exhausted air from the collection units will be discharged to atmosphere. Dust accumulated in the units will be deposited in the storage silos along with the materials removed by the screens for disposal by railroad car. This dust supression technique will be utilized during railroad car loading.

There will be six separate baghouses with separate fans, one at each exhaust point. These baghouses have design emission rates of 428 lb/hr, corresponding design exit concentrations of .005 gr/scfd and design removal efficiencies of 99.9 percent. The fines collected by the baghouses will be discharged onto a covered conveyor system to covered silos. A wetting agent is sprayed on the dust to control it. The wetted dust is sent to the sinter plant for agglomeration and subsequent charging to the blast furnace. Figures 4-8 and 4-9 provide schematic depictions of the material handling and charging areas.

The dust suppression system also employs a solution of water and a wetting agent to produce a fog-type spray through the nozzles to envelop and contain dust which may be generated during railroad car loading. Application of the liquid spray is controlled by electrical interlocks and switches to activate sprays at specific locations only when equipment at that location is operating.

4.3.6. Boilers

Steam boilers power the blowers which force air into the furnace and also turn the generators which produce the electrical current required by many other facilities at the Fairfield plant. These boilers normally burn generated blast furnace gas. A secondary fuel supply that enriches the mix is coke oven gas. Beyond these two supplies, natural gas is the third fuel to be fired if the other two enriching sources are unavailable.

Failure of supply of the two secondary sources of fuel (coke oven gas and natural gas) causes the automatic firing of a fuel oil supply to the boilers. Particulate emissions in the event that fuel oil will be burned will be 0.1 lb/1,000 BTU's of oil fired. Maximum oil that could be fired per boiler is 32,645 lb/hr (603,930,000 BTU/hr). The boilers are 425,000 lbs steam capacity with 300,000 lbs produced by blast furnace gas and 125,000 lbs by secondary fuel.

The SO_2 would be 1.08 lb/1,000 BTU if only oil fired. The NO_x would be 0.3 lb/1,000 BTU if only oil fired. However, the blending of fuels will reduce this emission rate.

The lean blast furnace gas burned by the stoves is enriched with natural gas before being fired. The boilers will use natural gas stabilizing burners instead of enriching the blast furnace gas before firing.

4.3.7. Blast Furnace Gas Emission Summary

Raw Gas

50 lb dust/ton iron
125 tons/day dust (173.6 lb/min)
Moisture - .004 lb H_2O/cu ft
Temperature - $350^{o}F$-$500^{o}F$
Pressure - 4 to 30 psig

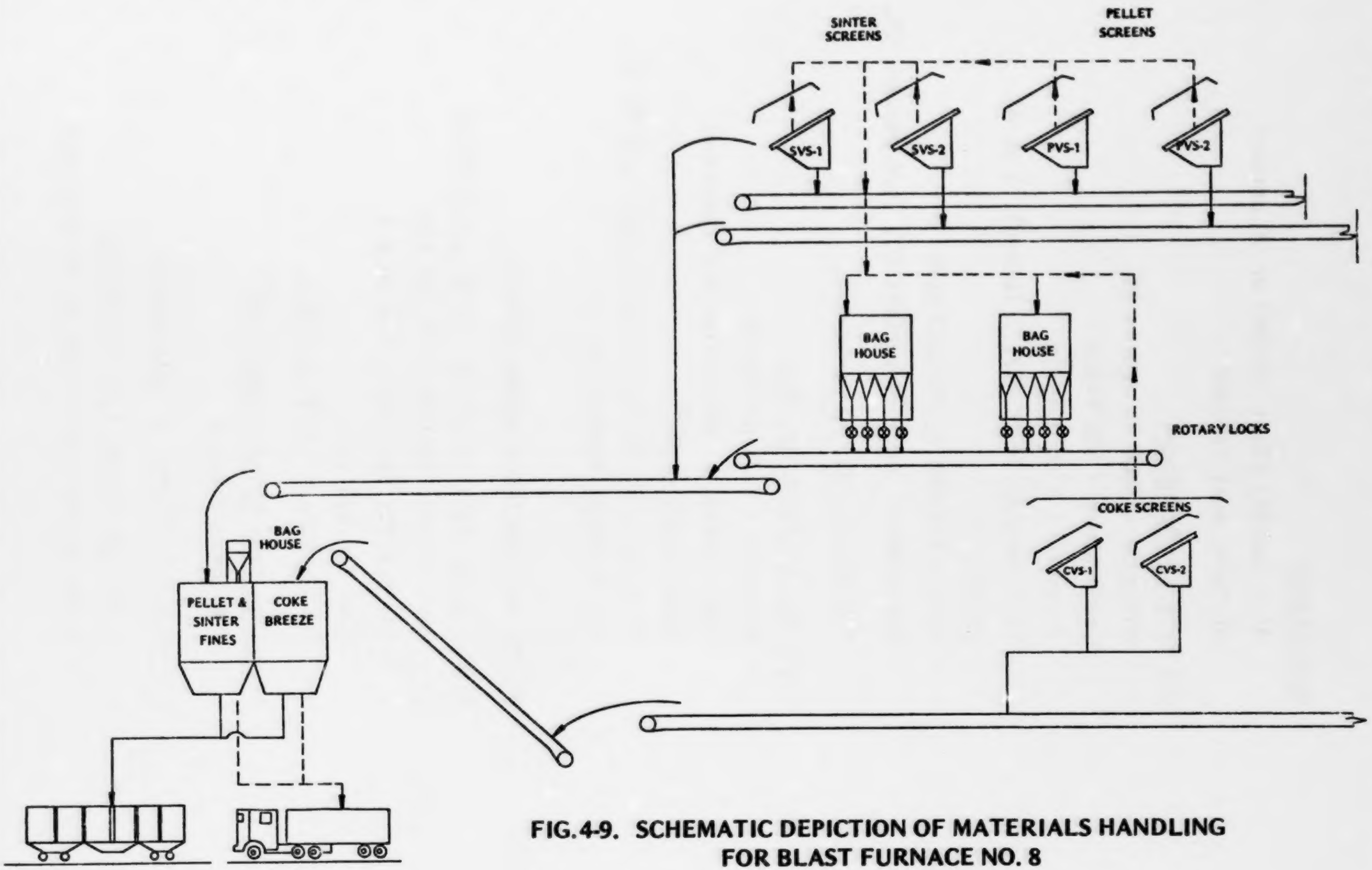

SINTER SCREENS
PELLET SCREENS
SVS-1
SVS-2
PVS-1
PVS-2
BAG HOUSE
BAG HOUSE
ROTARY LOCKS
COKE SCREENS
CVS-1
CVS-2
BAG HOUSE
PELLET & SINTER FINES
COKE BREEZE

FIG. 4-9. SCHEMATIC DEPICTION OF MATERIALS HANDLING FOR BLAST FURNACE NO. 8

Dustcatcher

37.5 ton/day (52.1 lb/min) or 30 percent of total dust removed

Gas Entering Scrubber

Moisture - .004 lb H_2O/cu ft
Temperature - 350°F-500°F
Pressure - 4 to 30 psig
87.5 tons/day dust (121.5 lb/min), 3 to 4 grains/scf
Flow - 149,000 to 297,000 scfm
Gas Composition - 26 percent CO, 14.4 percent CO_2
1.6 percent H_2, 58 percent N_2

Clean Gas to Plant Gas Main

Moisture - 2.35 grains/scf
Dust Loading - .005 grains/scf (maximum)
Temperature - 100°F
Pressure - 20 in. H_2O in plant main and 85 in. H_2O in blast furnace No. 8

4.3.8. Wastewater Treatment System Summary

Slurry Water (gas vessel to spiral classifier)

Dust Content (solids) - 2,180 ppm
Sp. Gravity (solids) - 3.5 to 4.5
Flow - 6,600 gpm
Temperature - 140°F (maximum)

Discharge from Spiral Classifier

1.0 ton/day solids

Slurry H_2O (influent to thickeners)

3,300 gpm normal (per thickener)
6,600 gpm maximum to one 80 ft thickener

In - 2,180 ppm suspended solids
Out - 50 ppm (long-term average) normal
Cationic Polymer Feed - 5 ppm
Anionic Polymer Feed - 1 ppm

Sludge (thickener underflow) to Vacuum Filters
Solids - 35 to 50 percent by weight
Specific gravity (solids) - 3.5 to 4.5

Vacuum Filter Discharge
Solids - 75 percent (minimum) by weight,
86.6 tons/day

Through Cooling Towers
Evaporation - 120 gpm (each)
Influent Temperature - 140°F (maximum)
Effluent Temperature - 90°F (maximum)

Blowdown (intermittent to plant treatment including final effluent pond)
Flow - 430 gpm, 125 gal/ton iron
Long-Term Average Concentrations - Suspended Solids, 50 ppm; Cyanide (total), 15 ppm; Phenol, 1.0 ppm; Ammonia (as NH_3), 62 ppm

4.3.9. Furnace Cooling System Summary

Flow - 13,700 gpm
Through Cooling Towers (2)
Evaporation - 270 gpm (each)
Influent Temperature - 125°F (maximum)
Effluent Temperature - 100°F (maximum)

Blowdown
Flow - 800 gpm (5 percent) to waste treatment make-up, gas cleaning, etc.

4.3.10. Water Discharges

Blast Furance No. 8. Blast furnace No. 8 will require an additional 4.6 mgd of water at Fairfield (see Table 4-2). Based on experience with the other operating blast furnaces at Fairfield, the effluent stream generated by the facility will be less than 1 mgd to the existing waste stream from the blast furnace area going to the final effluent control pond. The remaining water is lost through evaporation during cooling operations associated with the blast furnace.

4.3.11. Solid Waste Management and Disposal

The solid waste disposal methods utilized by U. S. Steel at the Fairfield Works do not impact the environment to any appreciable extent. It is expected that the new facilities will function in a manner that solid waste disposal will not have an adverse effect on the ecosystems of the area. Present waste management practices are expected to continue at the new facilities. Basically, solid waste disposal practices are as follows:

Oil - Waste oil is a mixture of Bunker C (3,000 gal/yr) and diesel fuel (6,000 gal/yr). Waste oil is either reused in combination with slag to construct traffic arteries and roads within the confines of U. S. Steel property or it is transported to waste oil reclaim operations.

Filter Cake - This residue is disposed of in a landfill, the Exum Dump, the location of which is depicted in Figure 4-10. The three primary sources of filter cake are:

1. Coke Plant Lime/Bio Mass - This produces approximately 3,300 dry tons annually.

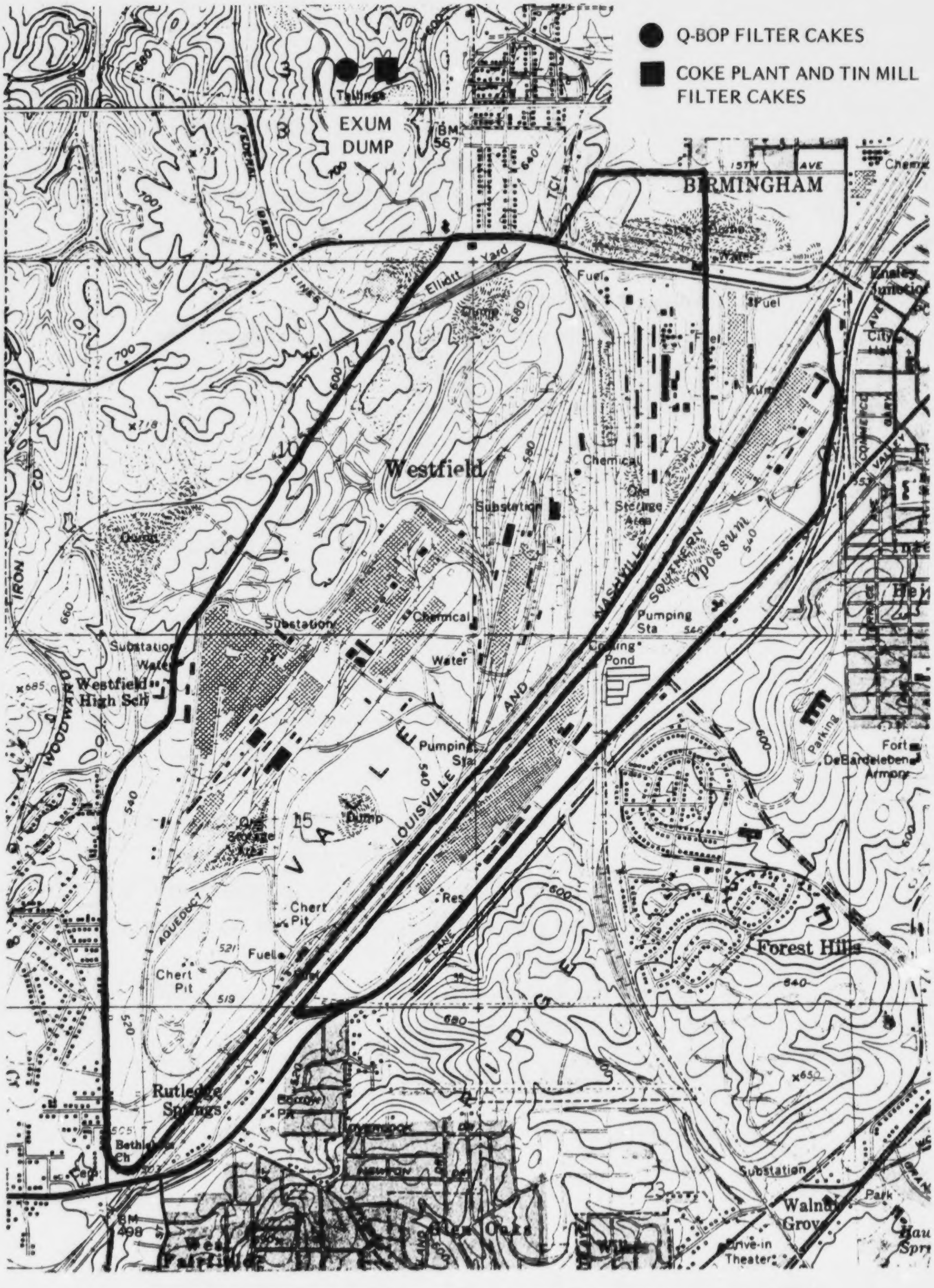

● Q-BOP FILTER CAKES
■ COKE PLANT AND TIN MILL FILTER CAKES
EXUM DUMP
Tailings
BM 567
BIRMINGHAM
15TH AVE
Elliott
Yard
Dump
Fuel
Ensley Junction
City Hall
Kiln
Westfield
Chemical
Substation
Ore Storage Area
Opossum
SOUTHERN
NASHVILLE
AND
LOUISVILLE
Pumping Sta
Cooling Pond
Water
Westfield High Sch
Dump
Ore Storage Area
V A L L E Y
R I D G E
Chert Pit
Fuel
Res
Forest Hills
Fort DeBardeleben Armory
Parking
Rutledge Springs
Bethlehem Ch
Borrow Pit
Substation
Walnut Grove
Drive-in Theater
Glen Oaks
BM 498
IRON
WOODWARD
AQUEDUCT
TCI
LINES
Park
700
680
660
640
600
580
540
520
521
519
505
x718
x685
x652

FIG. 4-10. LOCATION OF U. S. STEEL FACILITIES – LAND FILL SITES

2. Tin Mill Treatment Plant - Approximately 15,800 tons annually.
3. Q-BOP - Sludge and filter cake residue of 15,200 tons annually.

Part of the filter cake is recycled by sending it through the sinter plant.

Sludge - There are four sources of sludge and the disposition is as follows:

1. Sintering - Stock.
2. Blast Furnace - Recycled as sinter.
3. Rolling - Recycled as stock/sinter.
4. Pickling - Landfill on property.

Dust - From limestone is recycled; from transport systems is recycled; from scrubber is settled, thickened and transferred to a landfill; from blast furnace is transported to the sinter plant for recycling; from Q-BOP to stock.

Scale - From rolling mills is transported to the sinter plant for recycling. It is recycled in the blast furnace.

Slag - An independent contractor removes part of the slag then processes it to remove iron. He then sells it to another contractor who, in turn, resells it for highway construction. It is used on property for roadways.

Construction Rubble and Debris - Hauled to a USSC dump site on USSC property.

Trash - Transported by USSC to a landfill on Oxmoor Road operated by Jefferson County. Officials of the Jefferson County, Alabama, Public Health

Department indicate there is, to their knowledge, no dumping of industrial wastes on any of the public landfilT sites.

A detailed listing of the types of residuals, their compositions, and ultimate disposal site locations is presented in Appendix F to the TSD.

5. IMPACTS OF THE PROPOSED ACTION

CHAPTER 5

IMPACTS OF THE PROPOSED PROJECT

5.1. AIR QUALITY

5.1.1. Future Conditions with the Proposed Action--Total Suspended Particulates (TSP)

The results of the ambient air quality modeling analysis in comparing conditions occurring in the Birmingham area in 1972 (Condition 1) and those which will occur as a result of the proposed action (Condition 5) are presented in Figure 5-1. Figure 5-1 depicts the percent reduction of the U. S. Steel Corporation's contribution to the ambient TSP concentrations as a result of the proposed new facilities (Condition 5, referenced to Condition 1). The analyses reveal a maximum reduction of 90 percent in TSP concentrations corresponding with the installation of the proposed new facilities and it is apparent that a substantial overall reduction in TSP concentrations will occur with the installation of the proposed new facilities. Figures 5-2 and 5-3 show the absolute magnitudes of the concentrations predicted by the model for Condition 1 and Condition 5, respectively. These figures indicate the area of impact around U. S. Steel's facilities subject to inaccuracies due to limitations in the model which have been discussed previously. Based on these analyses, it is concluded that installation of the proposed new facilities will have a positive impact with regard to its influence on the air quality of the surrounding community and should contribute to improve general environmental conditions. A reduction in U. S. Steel emissions and concomitant improvement in air quality would result from application of best technology to both new and existing sources, including the construction of the proposed new blast furnace (Condition 5).

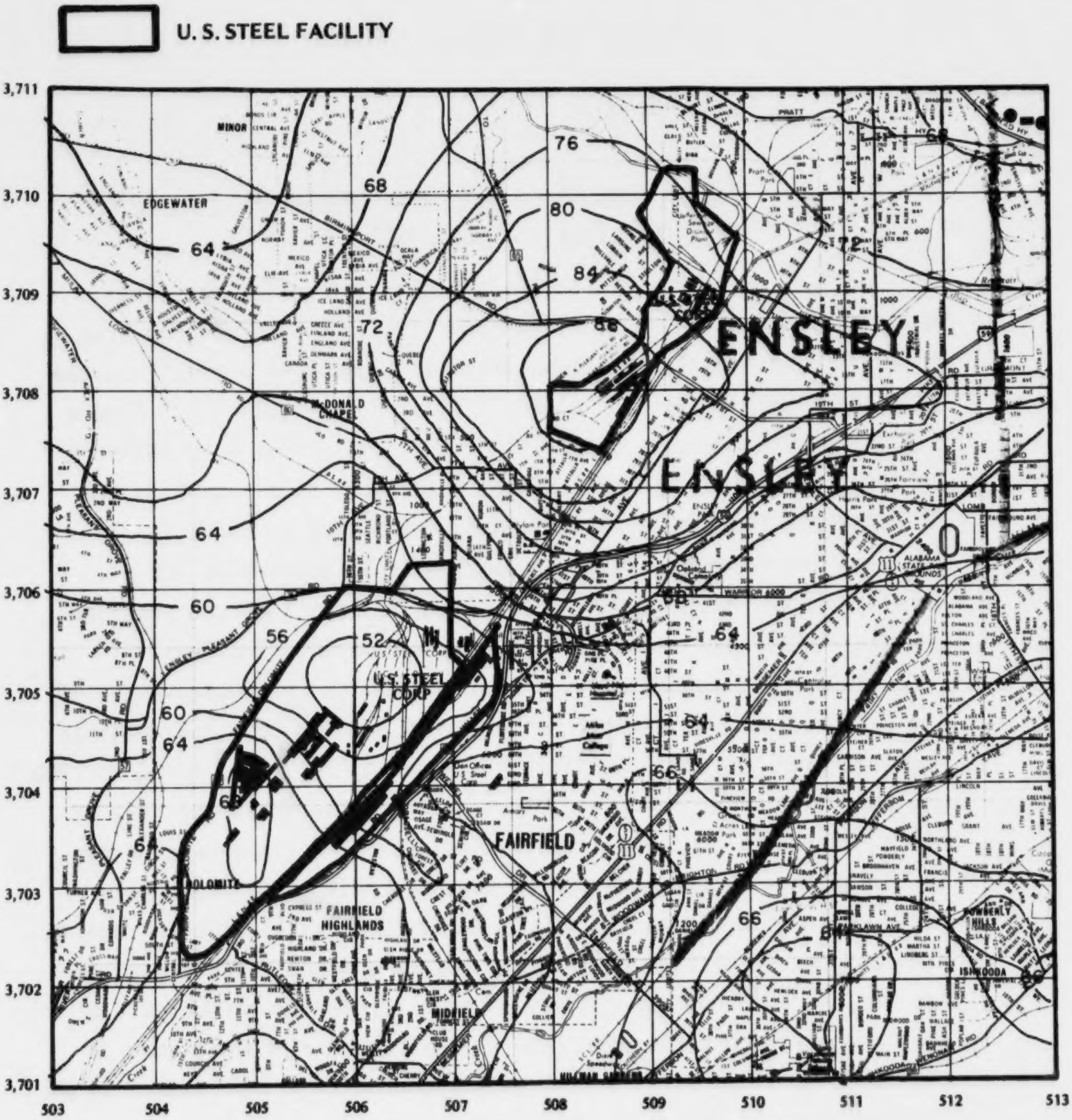
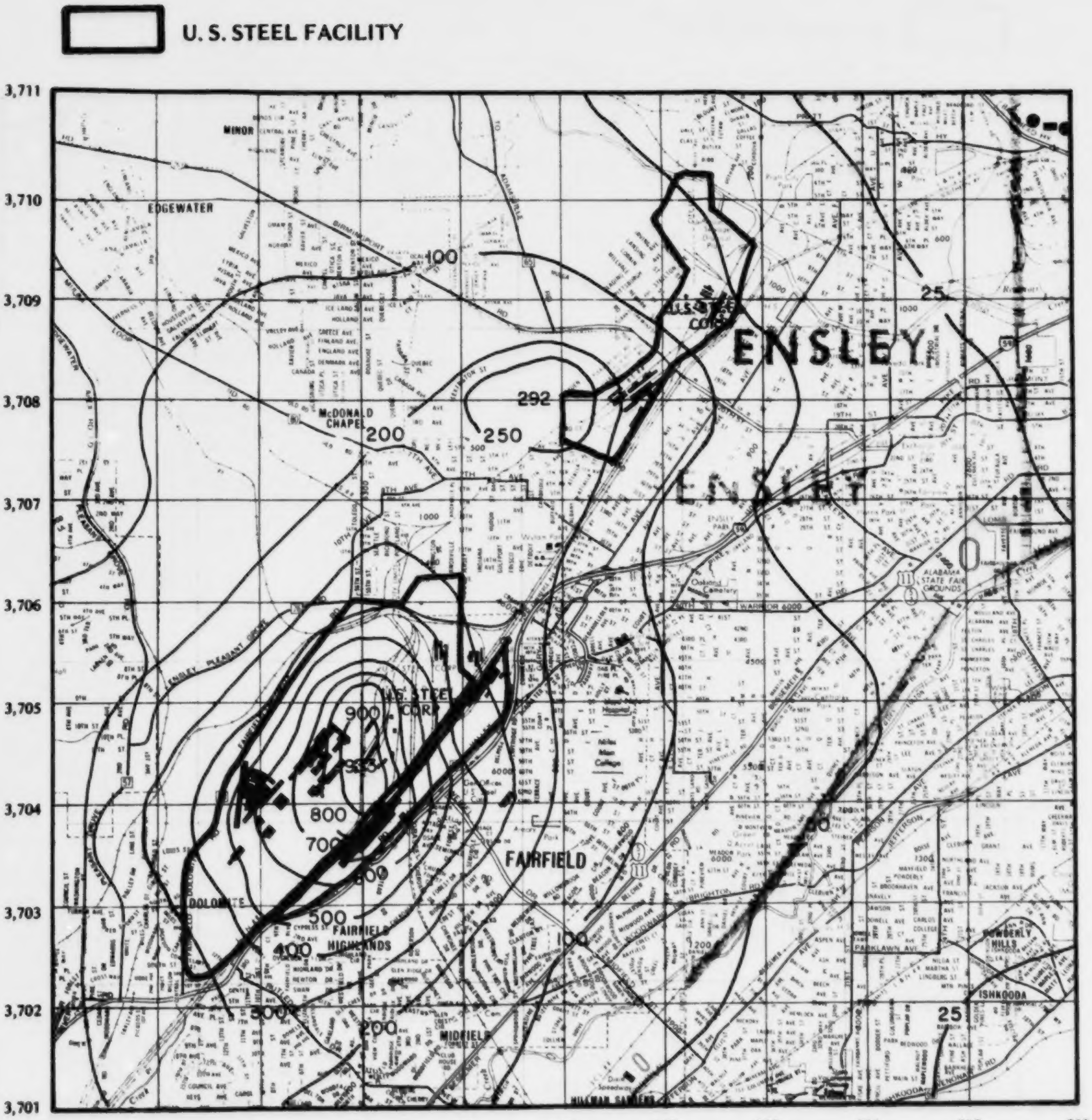

U. S. STEEL FACILITY
3,711
3,710
3,709
3,708
3,707
3,706
3,705
3,704
3,703
3,702
3,701
503
504
505
506
507
508
509
510
511
512
513
MINOR
EDGEWATER
McDONALD CHAPEL
ENSLEY
ENSLEY
FAIRFIELD
FAIRFIELD HIGHLANDS
DOLOMITE
MIDFIELD
U.S. STEEL CORP
76
68
80
84
88
72
64
72
64
60
56
52
60
64
68
64
68
64
64
66
66
64
68

FIG. 5-1. PERCENT REDUCTION OF USSC CONTRIBUTION TO AMBIENT PARTICULATE CONCENTRATIONS FOR CONDITION 5
% = (CONDITION 1 – CONDITION 5)/CONDITION 1 x 100


U. S. STEEL FACILITY
3,711
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3,705
3,704
3,703
3,702
3,701
503
504
505
506
507
508
509
510
511
512
513
MINOR
EDGEWATER
100
292
250
200
McDONALD CHAPEL
U.S. STEEL CORP
ENSLEY
25
900
800
700
600
500
400
300
200
100
U.S. STEEL CORP
FAIRFIELD
DOLOMITE
FAIRFIELD HIGHLANDS
MIDFIELD
ALABAMA STATE FAIR GROUNDS
ISHKOODA
HILLMAN GARDENS

FIG. 5-2. USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 1

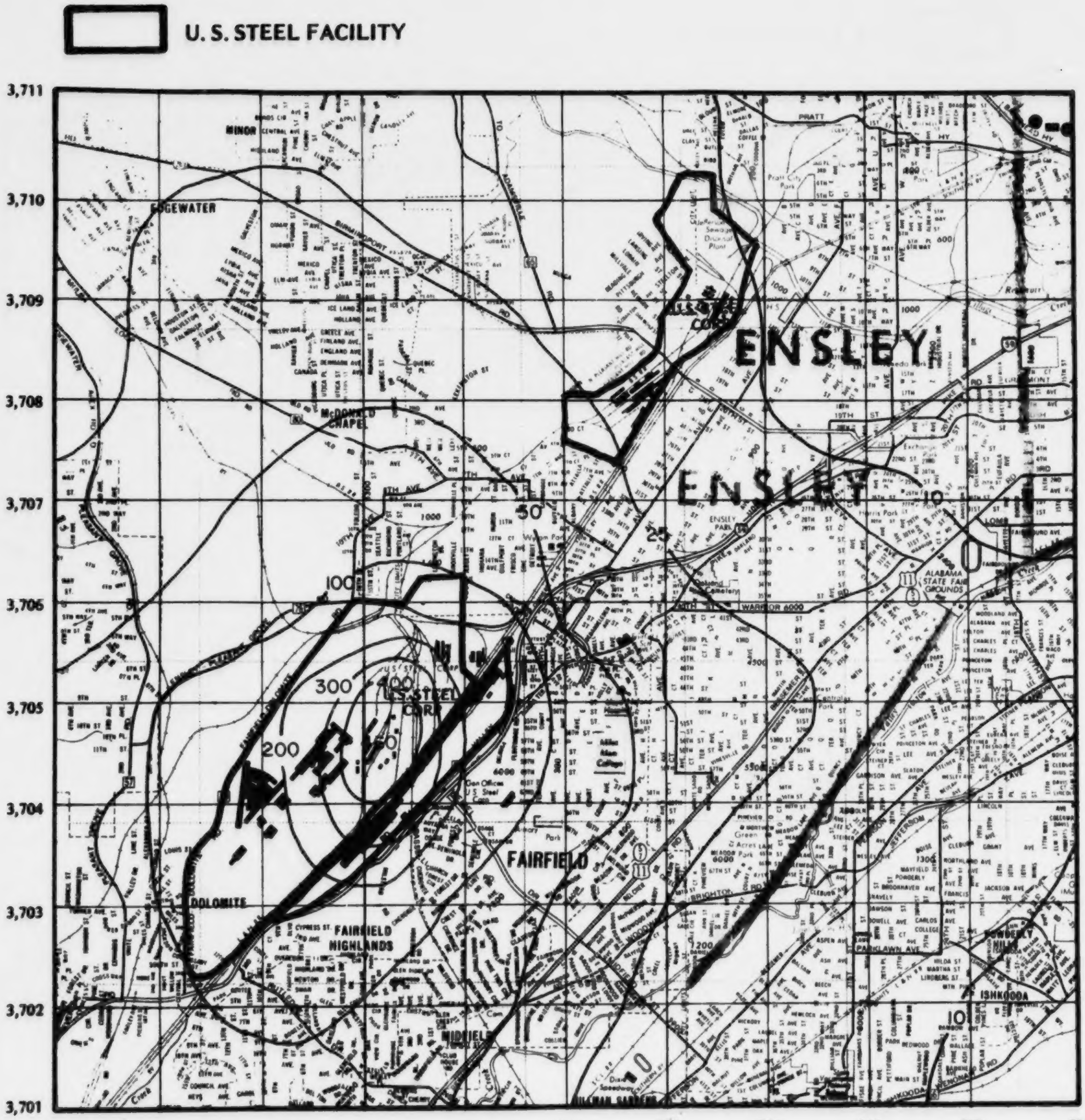

U. S. STEEL FACILITY
3,711
3,710
3,709
3,708
3,707
3,706
3,705
3,704
3,703
3,702
3,701
503
504
505
506
507
508
509
510
511
512
513
ENSLEY
ENSLEY
EDGEWATER
MINOR
McDONALD CHAPEL
FAIRFIELD
FAIRFIELD HIGHLANDS
DOLOMITE
MIDFIELD
ISHKOODA
PRATT
ALABAMA STATE FAIR GROUNDS
U.S. STEEL CORP
100
300
400
200
50
25
10
10
0
0

FIG. 5-3 USSC CONTRIBUTION TO AMBIENT EXPECTED ARITHMETIC MEAN OF PARTICULATES FOR CONDITION 5

5.1.2. Future Conditions with the Proposed Action--Other Pollutants

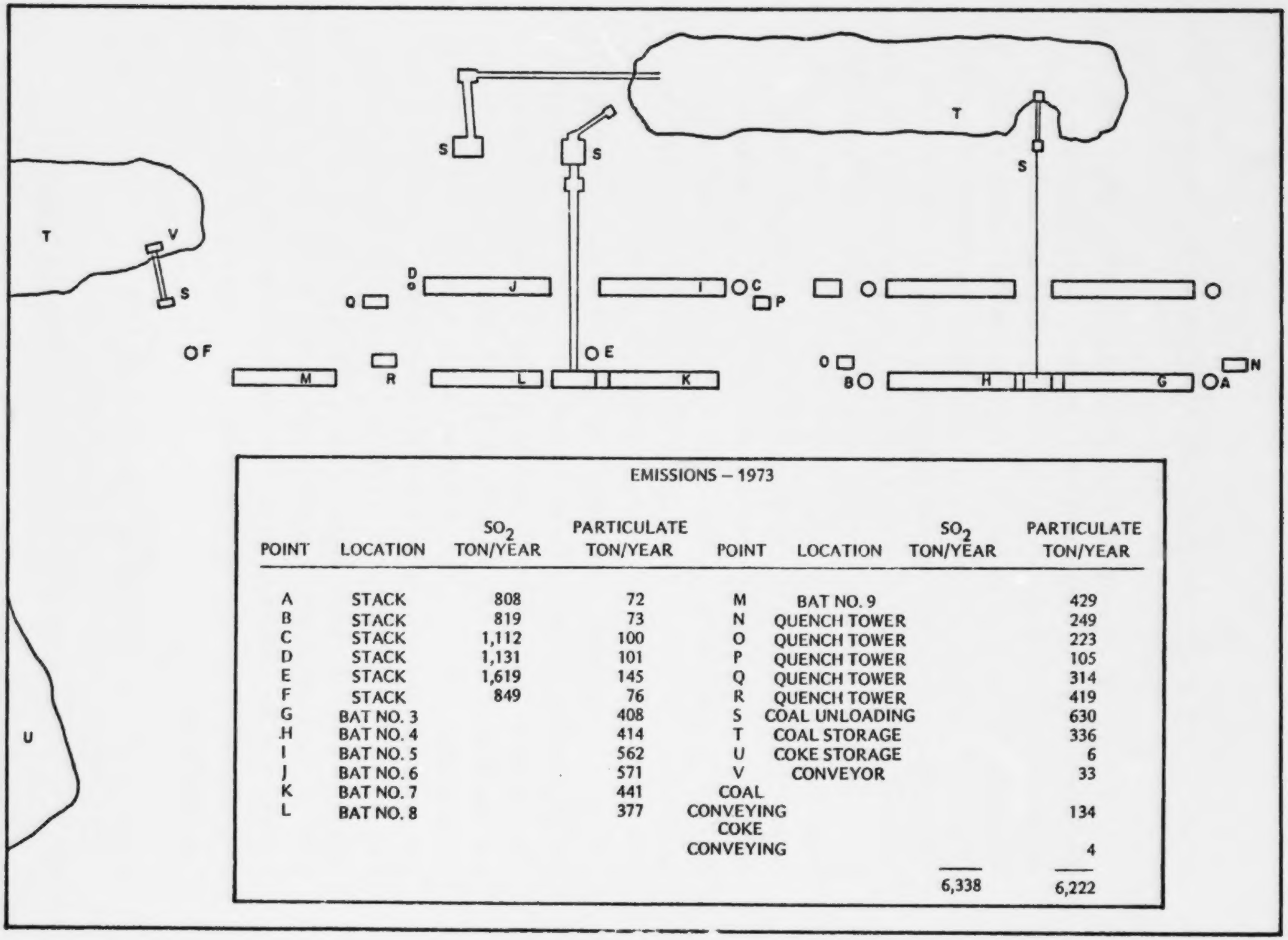
No attempt was made to model pollutants other than TSP from air quality considerations. However, based on past and projected emission rates for sulfur dioxide (SO_2) and analysis of the proposed process modifications and replacement facilities, it is anticipated that ambient SO_2 and hydrocarbon concentrations will not increase as a result of the proposed action. Figures 5-4 and 5-5 present SO_2 and particulate emission rates provided by U. S. Steel. Actual particulate emission rates used in the modeling differed from those depicted in these figures. Inspection of Figures 5-4 and 5-5 reveals a reduction in SO_2 emission rates from coking facilities, compared to 1973. Neither the coking capacity nor the source of coal will change during future operations compared to conditions in the past. The U. S. Steel Corporation is presently in compliance with appropriate emission regulations concerning SO_2.

As part of the March 31, 1978, settlement agrement with the Alabama Air Pollution Control Commission, the State of Alabama, the Jefferson County Board of Health, the United States of America, and the Administrator of the EPA, U. S. Steel Corporation must submit a hydrocarbon offset to the Jefferson County Department of Health for the preheater and related coke battery facilities. This hydrocarbon offset will be available for review by the public at the Jefferson County Health Department prior to the start-up of the preheater. There will not be a substantial environmental impact as a result of the proposed action from the standpoint of pollutants other than total suspended particulates, providing the hydrocarbon emissions can be reduced to an acceptable level.

5.2. SOCIO-ECONOMIC CONSIDERATIONS

5.2.1. Future Environment with the Proposed Action

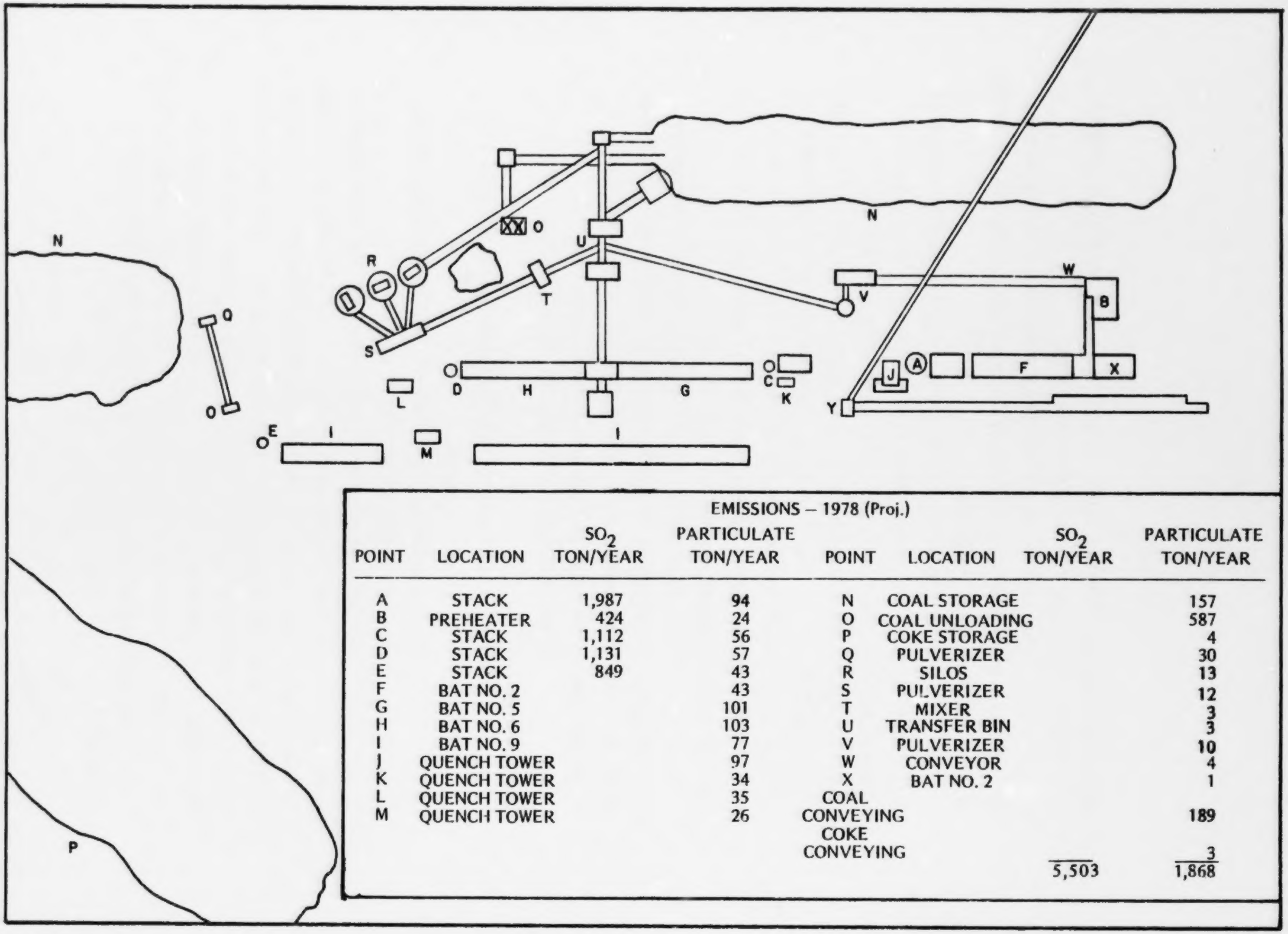
The extractive industry and its attendant activities comprise the major foundation of the economy of Birmingham and



EMISSIONS – 1973

POINT	LOCATION	SO_2 TON/YEAR	PARTICULATE TON/YEAR	POINT	LOCATION	SO_2 TON/YEAR	PARTICULATE TON/YEAR
A	STACK	808	72	M	BAT NO. 9		429
B	STACK	819	73	N	QUENCH TOWER		249
C	STACK	1,112	100	O	QUENCH TOWER		223
D	STACK	1,131	101	P	QUENCH TOWER		105
E	STACK	1,619	145	Q	QUENCH TOWER		314
F	STACK	849	76	R	QUENCH TOWER		419
G	BAT NO. 3		408	S	COAL UNLOADING		630
H	BAT NO. 4		414	T	COAL STORAGE		336
I	BAT NO. 5		562	U	COKE STORAGE		6
J	BAT NO. 6		571	V	CONVEYOR		33
K	BAT NO. 7		441	COAL CONVEYING			134
L	BAT NO. 8		377	COKE CONVEYING			4
						6,338	6,222

FIG. 5-4. SO_2 AND PARTICULATE EMISSIONS - 1973



EMISSIONS – 1978 (Proj.)

POINT	LOCATION	SO_2 TON/YEAR	PARTICULATE TON/YEAR	POINT	LOCATION	SO_2 TON/YEAR	PARTICULATE TON/YEAR
A	STACK	1,987	94	N	COAL STORAGE		157
B	PREHEATER	424	24	O	COAL UNLOADING		587
C	STACK	1,112	56	P	COKE STORAGE		4
D	STACK	1,131	57	Q	PULVERIZER		30
E	STACK	849	43	R	SILOS		13
F	BAT NO. 2		43	S	PULVERIZER		12
G	BAT NO. 5		101	T	MIXER		3
H	BAT NO. 6		103	U	TRANSFER BIN		3
I	BAT NO. 9		77	V	PULVERIZER		10
J	QUENCH TOWER		97	W	CONVEYOR		4
K	QUENCH TOWER		34	X	BAT NO. 2		1
L	QUENCH TOWER		35	COAL CONVEYING			189
M	QUENCH TOWER		26	COKE CONVEYING			3
						5,503	1,868

FIG. 5-5 SO_2 AND PARTICULATE EMISSIONS - 1978 (PROJECTED)

Jefferson County, Alabama. This economy is substantially dependent upon steel production and related activities.

Projections of future growth for the Birmingham area by local and state planners rely heavily on assuming continuing growth of the iron and steel industry.

U. S. Steel is the primary influence in Birmingham's metal facilities. Due to the fact that in 1975 the U. S.'s share of world steel production was only 16.3 percent, an additional 35 million tons are needed by 1980. In order to maintain its existing production, U. S. Steel proposes construction of a new blast furnace. This will enable certain antiquated facilities to be phased out. An estimated increase of 600,000 tons per year of steel will be produced at the new facilities.

To assess impact to the economy, certain estimates must be made. An estimate of regional output of iron and steel products for 1980 dollar-wise is $738,469,000 (Birmingham Regional Planning Commission Batelle-Columbus Laboratories, 1976).

Other estimates of types of direct changes to consider are assumption of:

1. A decrease in the regional output of iron and steel products.
2. A decrease in personal consumption spending as a result of decreased payrolls.

At the present time, the economy of the Birmingham area is healthier than at any previous time. To continue this trend, proper balances must occur in employment diversification. Any major decline in expected expansion in any of these areas could result in higher rates of unemployment. The only adverse impact would be a reduction of 22 employees assuming installation of blast furnace No. 8. This is an insignificant effect on the overall economy. Details concerning this evaluation can be found in the Technical Support Document.

5.3. WATER QUALITY

5.3.1. Future Conditions with the Proposed Action

In considering the future conditions with the proposed action, the waste discharges contributed to receiving streams will be shifted with regard to U. S. Steel's facilities. The present discharges on Village Creek will be reduced substantially and some increase in discharges to Valley Creek through Opossum Creek will occur. The proposed action will reduce U. S. Steel Corporation discharge to Village Creek as follows: 13.0 lb/day of cyanides; 1.8 lb/day of phenols; 103 lb/day of ammonia; and 1,668 lb/day of suspended solids. The future conditions on Opossum and Valley Creeks with construction of the new blast furnace will result in increased loadings as follows: suspended solids increase 52 lb/day; cyanides increase 1.3 lb/day; phenols increase 2.77 lb/day; and ammonia increases 52 lb/day (based on BATEA effluent limitations; see Chapter 6).

The impact on Village Creek of the proposed action will be to reduce the contributions of pollutants from the U. S. Steel facility. As discussed for Valley Creek, a measurable alteration of the environment probably will not occur as a result of the proposed action. Similar comments apply to an improvement in water quality conditions as a result of reduction in waste load discharges by U. S. Steel to Village Creek. Considering the large quantities of contaminants entering Village Creek as a result of other point and non-point sources, the final accurate prediction of improved water quality conditions must be questioned. Nevertheless, it is appropriate to indicate that some improvement to the backwaters of Bayview Lake will accompany the improvement in the reduction of waste load discharges to Village Creek from municipal facilities as well as U. S. Steel Corporation. The resulting improvement below Bayview Lake is dependent on the lake recovery which may not occur (for an extended period of time) even if all contaminants cease to be discharged to this reservoir.

An indication of the impact of the new blast furnace on the water quality in Valley Creek at BAT levels of treatment can be obtained from a water quality model of Valley Creek. According to the model predictions the blast furnace will decrease the dissolved oxygen in the river at the critical point by approximately 0.12 mg/l, increase the ammonia nitrogen concentration by approximately 0.1 mg/l, increase the phenol concentration by 0.012 mg/l and increase the cyanide concentration by 0.001 mg/l at the 10-year seven-day low flow condition.

It must be kept in mind that these predictions are made based on the assumption that all biological decay rates will remain constant and that changes in the nature and level of waste loads to the river have no effect on the kinetics of the biological processes taking place in the river. However, significant changes in the nature and amount of the waste being discharged to Valley Creek will take place. The discharge of materials known to be inhibitory to biochemical oxidation will be substantially reduced from the U. S. Steel discharge and there will also be a substantial reduction in the amount of oxygen demanding material. At the same time, it is expected that the discharge from the Valley Creek Sewage Treatment Plant will approximately double in volume and that the concentration of oxygen demanding material in the waste will also increase as the plant is brought up to its designed capacity. In light of the radical changes that are expected in the wastes discharged to Valley Creek it can be anticipated that there will be chances in the biological kinetics affecting the water quality of Valley Creek. Exactly what this effect will be, however, cannot be determined with present technology.

5.4. BIOLOGY

5.4.1. Future Conditions with the Proposed Action

As stated in Section 5.3., adoption of the proposed action will increase loadings of suspended solids, cyanides, phenols, and ammonia to Opossum and Valley Creeks. A decrease in the loadings of these substances to Village Creek will also accompany adoption of the proposed action. Overall impacts on water qualtiy will be a net reduction of 8.9 MGD of wastewater, 1,616 lb/day of total suspended solids, 51 lb/day of ammonia-nitrogen, 11.7 lb/day of cyanides and a net increase of 0.97 lb/day of phenols discharged to the tributaries of Bankhead Reservoir.

In the following analysis, the impacts of the proposed action on the future environment are evaluated from the standpoint of the Recovery Index methodology introduced in Chapter 3.

1. Existence of nearby epicenters for providing organisms to reinvade a damaged system. (The existence of nearby epicenters was given a rating of poor for all of the streams affected. Adoption of the proposed action will not alter this rating.)
2. Transportability or mobility of dissemules--the dissemules might be spores, eggs, larvae, flying adults which might lay eggs, or other stages in the life history of an organism which permits it either voluntarily or involuntarily to move to a new area. (No fish and only a few invertebrates were found in Opossum Creek at the upstream reference station. Therefore transportability or mobility of dissemules was rated as poor for Opossum and the proposed action would not alter this rating. While U. S. Steel Corporation's discharges to Village Creek will be reduced, no significant alteration of transportability or mobility is anticipated and Village retains a rating of moderate. Similarly, while Valley Creek will receive increases in

loadings of solids, cyanide, phenols, and ammonia, in-stream levels of these components are not anticipated to change significantly. Consequently, Valley Creek will retain a moderate transportability and mobility of dissemules.)

3. Condition of the habitat following pollutional stress. (Adoption of the proposed action will not alter the physical habitats and the rating for Opossum remains at poor and that of Valley and Village at good.)
4. Presence of residual toxicants following pollutional stress. (Sediment analyses for heavy metals and organics indicate that all stream sediments contain large amounts of residual toxicants.)
5. Chemical-physical environmental quality after pollutional stress. (Village and Valley Creeks were given a moderate rating for chemical-physical environmental quality. This is based on the fact that physical substratum has not been significantly altered. Opossum, on the other hand, is rated as being in severe disequilibrium.)
6. Management or organizational capabilities for immediate and direct control of damaged area. (All creeks are given a rating corresponding to some management or organizational capabilities due to the existing 208 studies in Jefferson County.)

As a result of the above analysis, none of the streams have the potential for rapid recovery. This is the case with or without the new source. A similar analysis was performed using the Inertia Index and yielded results identical to those obtained without the proposed action.

6. DISCUSSION OF ALTERNATIVES

CHAPTER 6

DISCUSSION OF ALTERNATIVES

6.1. BUILD OR NO-BUILD

From the turn of the century until the early years of this decade, all of the steel which was produced at what is now Fairfield Works was produced by the open hearth process. Nine furnaces were built at Ensley, and later twelve furnaces were built at Fairfield. Four of the Ensley furnaces were permanently shut down in 1962. As production rates increased through improved technology, environmental concerns heightened. The emissions from these furnaces became a matter of great concern to the public and to U. S. Steel.

Due to obsolescence, it was quite clear that the years of the Ensley open hearths were limited. The solution to the emission problem at the remaining furnaces at Ensley had to be replacement facilities or a permanent discontinuance of operations as the cost of control equipment could not be justified in view of their limited remaining life.

At Fairfield, a decision was made in 1971 to install precipitators on the 12 open hearth furnaces, but the advent of a new steelmaking technology--the Q-BOP furnace--brought about the decision to replace the 12 Fairfield furnaces with a two-furnace Q-BOP facility, which provided control of steelmaking emissions at Fairfield.

A decision on shutting down the Ensley open hearths without replacing the capacity was separately addressed. If the Ensley open hearths were to be shut down without replacement, it would result in a 25 percent loss in steelmaking capability; the future of this plant would have been uncertain, and the effect on the community would have been severe. It is indisputable that a loss in steelmaking capability would not complement and respond to the well documented economic growth in the steel market in the South. Studies portrayed the opportunities available to U. S. Steel in maintaining its steelmaking capability in the market area served by the Southern Steel Division, and U. S. Steel moved forward with plans for new facilities to permit continued production of raw steel required for operation with Ensley's open hearths shut down. This assured the future of Fairfield Works as a major steel-producing facility, a matter of great significance to Birmingham, to Alabama, and to the South. This decision on the part of U. S. Steel Corporation would make Fairfield Works a modern, competitive steelmaking operation.

6.2. CAPACITY ALTERNATIVES

Various alternatives were studied to maintain raw steel production at Fairfield Works, occasioned by shutting down the Ensley open hearth furnaces. At least nine separate plans were evaluated as shown in Table 6-1.

During the third quarter of 1973, a recommendation evolved from these studies which specified that the best approach to meet existing conditions would be to displace Ensley open hearth operations with two 150-ton electric furnaces. It had been determined that air quality control devices on these five old open hearth furnaces could not be justified, and that production capacity should be replaced by modern steelmaking facilities, with effective emission control equipment to achieve compliance. Facility replacement was selected in preference to emission control equipment on existing furnaces, because to equip the Ensley open hearths with the necessary equipment to meet air pollution emission standards would require significant capital expenditures while being utilitarian for only a few years.

Electric furnaces which were contemplated would have had a capability of about 600,000 annual tons and the total raw steel requirement of the plant would have been met by increasing the Q-BOP output. At this time, it was estimated the Q-BOP capability could be

TABLE 6-1

ALTERNATIVES FOR PRODUCING STEEL
FAIRFIELD WORKS

Alternate	1	2	3	4	5	6	7	8	9
Project	Roof Burners & Precipitators at Ensley.	Roof Burners & Precipitators at Ensley.	Two 150-Ton Electric Furnaces at Ensley with In-Line Scrap Aisle. Added Teeming at Q-BOP Shop.	Two 150-Ton Electric Furnaces at Ensley with Parallel Scrap Aisle. Added Teeming at Q-BOP Shop.	One 200-Ton Electric Furnace at Q-BOP Shop with Parallel Teeming Aisle & Added Mixer.	Additional Teeming Aisle at Q-BOP Shop with Increased Production on Two Q-BOP Furnaces.	Three 150-Ton Electric Furnaces at Ensley with In-Line Scrap Aisles.	Three 150-Ton Electric Furnaces at Ensley with Parallel Scrap Aisles.	Third Q-BOP Furnace with Additional Teeming Facilities.
Steel Production									
Q-BOP Shop	2,700,000	2,700,000	2,930,000	2,930,000	3,100,000	3,500,000	2,700,000	2,700,000	3,500,000
Alt. Furnaces	560,000	635,000	570,000	570,000	400,000	--	800,000	800,000	--
Total (Annual Tons)	3,260,000	3,335,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000

increased with additional teeming facilities and provisions of additional hot metal through better burdening practices.

At the time of development, the electric furnace proposal was considered more desirable than adding a third Q-BOP furnace for several reasons:

1. Shorter construction time.
2. Better balance of iron and scrap.
3. Minimum interference with production.
4. Additional iron-making facilities would not be required.

Later, the electric furnace plan for Ensley was also updated and reevaluated against the alternative possibility of a third Q-BOP furnace at Fairfield. Several factors were considered:

1. The required expenditure for electric furnace facilities has increased to significantly more than that required for additional Q-BOP facilities at Fairfield.
2. An expanded Q-BOP operation at Fairfield would provide additional steel scrap, which is a valuable commodity in the steelmaking operation.
3. It appeared that additional funds might be available for investment in iron-producing facilities required to support the Q-BOP expansion. This alternative was considered since the Ensley blast furnaces were obsolete and emitted relatively large quantities of pollutants as compared to a new facility.

In October, 1974, after the start-up of the Q-BOP furnaces, a new plan was finalized which would displace both blast furnace and open hearth operations at Ensley. This proposal included a third Q-BOP furnace, teeming facilities, new soaking pits, and a new blast furnace at Fairfield.

The new facilities will permit continued production with adequate raw steel support required for operation with Ensley's open hearth shutdown.

6.3. PROCESS ALTERNATIVES

The blast furnace is the only available process for producing molten iron, the principal feed stock for a Q-BOP furnace. Therefore, no process alternatives were investigated.

6.4. SITE LOCATION

6.4.1. Criteria for the Site Selection

The new source, No. 8 blast furnace, is a support facility for steelmaking operations at Fairfield Works, replacing three existing blast furnaces at Ensley. Its site location can be explained easily and categorically with respect to locating it at another southeastern location, another location some place else in the country, or at a Greenfield site:

1. A blast furnace produces molten iron at an elevated temperature, and this hot liquid iron must be transported in insulated ladles to maintain its temperature, with a minimum transport time between where it is produced and where it is consumed. The reality of this physical situation dictates that the iron-making facility be conterminous with the steelmaking operation. For this reason, No. 8 blast furnace must be built contiguous with existing iron-making facilities at Fairfield Works.
2. Additionally, Fairfield Works is in the heart of the major southeastern city market for the consumption of steel products. Southeastern city market concentrations are depicted in Figure 6-1. From an economic view, it would be irrational to contemplate relocation of this steelmaking complex to a site remote from the distribution center of its saleable products, as it is now presently situated.

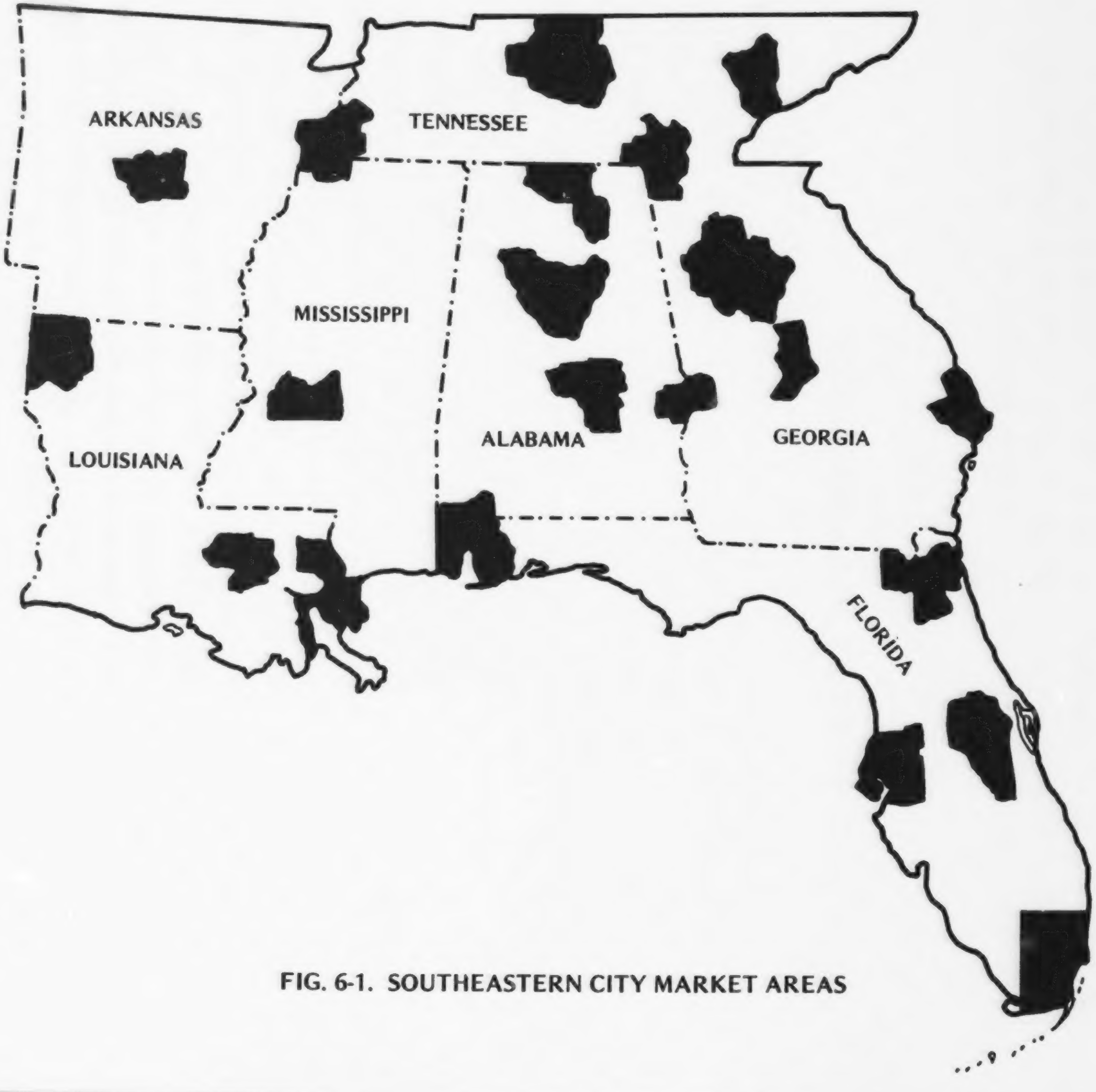

ARKANSAS
TENNESSEE
MISSISSIPPI
LOUISIANA
ALABAMA
GEORGIA
FLORIDA

FIG. 6-1. SOUTHEASTERN CITY MARKET AREAS

In assessing suitable land for industrial development, certain criteria must be met. Among the requirements considered by U. S. Steel Corporation were:

1. Slope and Topography - The Birmingham Regional Planning Commission, in their land use plans, recommends a level to slightly rolling topography with less than 10 percent slope for industrial development land.
2. Flood Prone Areas - These areas must not be located within the industrial complex as they would contribute to ground and surface water pollution. Well drained areas are desired.
3. Geology and Soils - Well drained sites that do hold water for long periods are most suitable.
4. Public Water - Coverage is necessary adjacent to the considered location.
5. Public Sewer - Coverage is necessary in the immediate vicinity.
6. Transportation Routes - Convenient transportation routes to and from a considered location for any industrial development are a must. Minimum disruption to present transportation systems is desirable.

The present transportation system is used as follows:

Incoming Raw Materials. Imported iron ore and pellets from foreign sources are unloaded at the USSC ore terminal or at Alabama State Dock at Mobile. These are transported by barge up the Warrior/Tombigbee River to Birmingham Port on the Locust Fork of the Warrior River. These materials are then transported by Birmingham Southern Railroad to Elliot Yard at Fairfield.

Dolomite is mined by open-pit quarrying at Dononah Quarry. Chunk dolomite is transported to the blast furnaces by rail. Crushed dolomite is carried by semi-trailers.

Coal is mined in the Warrior Coal Field and is also procured from other sources. Coal is barged to Birmingham Port and offloaded to facilities for washing. It is then transported by rail to the coke plant site.

Transportation of raw materials is by waterways and railroads that traverse the more sparsely populated parts of the region. This results in a less adverse impact to the environment than if another site were chosen which might necessitate routes that would contribute to an already overburdened transportation system. Therefore, the planned location is the most feasible from transportation considerations.

Raw Materials Handling. Emphasis is on making a clean separation of the coarse and fine material, and at the same time maintaining a high volume operation. With the start up of blast furnace No. 8, there will be a reduction in demand for iron ore and an increase in pellet ore use. Ore pellets are taken directly to the blast furnace area from pellet stockpiles for charging to the furnace. Individual pellet surfaces are very impervious to leaching in open-air stockpiles.

Burnt lime is required for the Q-BOP. The burnt lime process from dolomite leaves a calcium oxide residue. The residue is pumped into trucks and transported to a pressurized vessel at the Fairfield plant. Emissions can only occur by passage through the Q-BOP's, exiting the stack, or by accidental spillage from loading activities at the quarry. None of these contingencies constitutes major emissions.

Shipping Finished Products. There are adequate transportation systems contiguous to the proposed plant site. Seven major railroads serve the Birmingham area. Two of these--Louisville & Nashville and Birmingham Southern Railroads--are adjacent to the U. S. Steel facilities.

Port Birmingham is a major terminal for cargo shipments. The Black Warrior/Tombigbee Waterway is an important factor in commercial traffic. This system provides a useful transportation system for shipping.

Easy access from the planned site location to major highway systems is available. Interchanges to Interstate Highway 65 and 59 are nearby.

6.4.2. Determination

U. S. Steel Corporation already owns land that meets the requirements as outlined above, plus other criteria for a suitable plant location. For these many reasons, minimum adverse impact to the environment would be experienced as a result of selection of the proposed site. In summary, the Fairfield site was selected as the best alternative to maintain steel production for the Southeastern market.

The new blast furnace is to be located on the same baseline and north of existing blast furnaces at Fairfield Works. These existing furnaces are numbered 5, 6, and 7, from south to north. By situating the new furnace here, it will be sequentially numbered and known as "No. 8 blast furnace."

Because the existing coking operation lies close by, this is the most advantageous location for a new furnace from the standpoint of handling coke, which is one of the principal feedstocks for a blast furnace. Also, this is the only area contiguous to the existing blast furnace operation where there is available land for constructing a new furnace and its auxiliaries. For this reason, no other local sites were seriously evaluated.

6.5. WASTEWATER TREATMENT

The No. 8 blast furnace, as a new source, is required to meet New Source Performance Standards (NSPS) identified as Best

Available Demonstrated Control Technology (BADCT). The NSPS identified for a blast furnace are the same as Best Available Technology Economically Available (BATEA) and, consequently, the BADCT and BATEA effluent limitations are identical. All of the Phase I guidelines for the iron and steel industrial category, including all guidelines pertaining to a blast furnace, have been remanded by the courts. Therefore, the effluent limitations appropriate to BADCT for a blast furnace could change.

The U. S. Steel Corporation proposes to comply with the New Source Performance Standards by installing the equivalent of BATEA technology (Best Available Technology Economically Available consists of "Best Practicable Technology Currently Available" (BPTCA) plus treatment of cooling tower blowdown via alkaline chlorination, pressure filtration, carbon adsorption, and pH neutralization. BPTCA has been identified as polymer addition to thicken solids collected in gas cleaning operations and vacuum filtration of the thickened sludge. Emphasis has also been placed on water reuse utilizing cooling towers.). BPTCA and BATEA effluent limitations are presented in Tables 6-2 and 6-3, respectively.

A methodology for wastewater treatment, utilizing modification and optimization of processes and existing treatment facilities, has been selected by the U. S. Steel Corporation in accordance with the assumption that the NPDES permit for Fairfield Works will be revised to include the existing allocations, plus the BADCT allocations for a new blast furnace. The following information communicated by the U. S. Steel Corporation concerns this proposed wastewater treatment methodology:

TABLE 6-2

BPTCA EFFLUENT LIMITATIONS--BLAST FURNACE (FE) SUBCATEGORY

Parameter	BPTCA Limitation*	
	lbs/1,000 lbs	mg/l
Suspended Solids	0.0260	50.
Total Cyanide	0.0078	15.
Phenols	0.0021	4.
Ammonia (as NH_3)	0.0651	125.
pH	6.0 - 9.0	

* Referenced to flow of 125 gal/ton of Fe produced.

TABLE 6-3

BATEA EFFLUENT LIMITATIONS--BLAST FURNACE (FE) SUBCATEGORY

Parameter	BATEA Limitation*	
	lbs/1,000 lbs	mg/l
Suspended Solids	0.0052	10.
Cyanide$_A$	0.00013	0.25
Phenols	0.00026	0.5
Ammonia	0.0052	10.
Sulfide	0.00016	0.3
Fluoride	0.0104	20.
pH	6.0 - 9.0	

* Referenced to flow of 125 gal/ton of Fe produced.

1. No. 8 blast furnace has been designed to prevent ingress of any tramp or otherwise uncontrolled addition of water to the gas cleaning and cooling recycle system. As such, it will be the "tightest" such system built within USSC to date.

2. Process water from No. 8 furnace recycle system will be used as make-up for slag recycle systems. This is, in effect, a blow down for the No. 8 blast furnace gas cleaning system.

3. Only clean coke is produced at Fairfield Works. Clean coke is used to describe coke that is quenched in a closed recycle system using service water to make up evaporation losses. Clean coke contains an absolute minimum of phenol, cyanide and ammonia, and its use results in a minimum addition of these chemicals to the blast furnace water system.

4. Based on the burden and the furnace design, the coke rate on No. 8 blast furnace will be significantly lower than the industry average thereby further limiting the phenol, cyanide, and ammonia present in No. 8 blast furnace effluent. This is due to basic design as well as the quality of the prepared burden.

5. No. 8 blast furnace blowdown receives additional treatment together with other plant effluent in a final polishing pond prior to discharge.

6. It is expected that operating and treatment improvements in other areas of the plant will continue to be experienced, thereby further reducing the level of suspended solids, phenol, cyanide, and ammonia in the plant discharge.

Other wastewater treatment processes potentially applicable to specific constituents identified in effluents from a blast furnace, e.g., ammonia, cyanide, heavy metals, and phenols, are discussed in Appendix E of the TSD. These technologies, however, are either undemonstrated or uneconomic from the standpoint of treatment of an actual blast furnace effluent.

6.6 AIR EMISSION CONTROL ALTERNATIVES

This section discusses the alternatives to emission control technologies selected by U. S. Steel for implementation to control emissions from Blast Furnace No. 8, No. 2 Coke Battery and the third Q-BOP and includes all proven emission control metholodogies for the emission points discussed.

6.6.1. Coke Battery

As part of the construction of the new coke battery, storage bins for coal will be provided which will serve all existing batteries as well as the new coke battery at the Fairfield complex. Coal storage outside of the bins will be kept to a minimum. Anticipated emissions from the coal storage bins will be treated employing baghouses. Other techniques which could be employed include scrubbers or electrostatic precipitators. However, based on specific emission characteristics, energy requirements and equivalency in emission control alternatives, baghouses will be employed.

The alternative to the bin storage is ground storage which has a potential for emission of significantly greater quantities of coal dust and permits the coal to be wetted, resulting in additional energy requirements to dry the coal prior to coking. Reduced moisture addition was also considered in the selection of baghouses as opposed to wet scrubber systems for the removal of emissions.

Coal is then transferred to pulverizers which must be employed in order to reduce the coal size prior to coking. No alternative exists for the pulverizer and although other particulate removal controls exist for the air emissions, such as wet scrubbers, cyclones and precipitators, the baghouse will be employed because of equivalency for removing particulates, and prevention of additional moisture being added to the pulverized coal. After pulverization the coal is blended. All emissions are controlled by baghouses for the same reasons given for the storage silos and pulverizers. Transfer points along the coal conditioning train described above are all controlled employing baghouses. Other alternatives to this process would be uncovered conveyor belts and lack of emission control.

After blending, the coal is transferred to the silo which services a new coke battery which also has emission control devices to prevent particulate emissions during the discharge of coal into the silo. For similar reasons as described earlier, i.e., energy requirements for electrostatic precipitators as well as maintenance, and problems of wetting the recovered coal, baghouses are employed in the suppression of emissions from the silo. The coal is transferred from this silo to the secondary pulverizers whose emissions are also controlled by the same baghouses. From the silo the pulverized coal is transferred to the preheater which assures dryness of the coal and therefore most efficient discharge of powdered dried coal into the coking ovens.

Techniques which could be employed in the removal of emissions from the pre-heater include electrostatic precipitators, baghouses, and scrubbers. During design of the coal processing system, engineering decisions dictated that the wet scrubbers be employed because the electrostatic precipitators were being evaluated at other U. S. Steel installations and the scrubber is equivalent technology to the baghouse. Alternatives to the pre-heater are direct discharge of coal into the coke ovens bypassing the pre-heater system. Such a scheme would result in additional emissions from the coke batteries because of a requirement for leveling the coal immediately after being ejected into the coke oven. The leveling procedure requires opening of the coke oven thus permitting emissions. Leveling is not normally required if the pulverized coal is dried and pre-heated. Coal flows much like a liquid under these conditions. The pre-heated, pulverized coal naturally levels itself thus preventing the need for a leveling process.

The pulverized coal is transferred from the pre-heater to enclosed bins on the top of the coke battery. From these bins the coal is transferred to pre-metering bins. The emissions from all bins are controlled by wet scrubbers. Wet scrubbers were selected by equivalent technology. Both precipitators and baghouses could have been employed at this point in the emission control process. The coal is then transferred from the pre-metering bins to the charging device which places the coal in the coke oven. Three alternatives are available for charging. These are:

1. Conveyor charging
2. Pipeline charging
3. Hot Larry car

After investigation of these three techniques, it was determined that the most efficient method of charging coal, based on engineering decisions within the U. S. Steel Corporation, was the selection of a hot Larry car. The hot Larry car was determined to be equivalent technology with regard to emission control as well as process operation. The one designed and proposed for employment in the new coke battery at Fairfield is the result of the third generation design with U. S. Steel Corporation.

Mud sealing will be employed to prevent top side leaks during coking which is standard procedure and does not have an identifiable alternative.

The new coke battery has been provided with two collecting mains for the coke oven gases being released during the coking process. One main is adequate to conduct all coke oven gases during any phase of the coking operation to the by-product recovery system. Nevertheless, for added security, two mains have been provided which should insure reliable exhaustion of coke oven gases.

Emissions from coke oven doors can be controlled by two alternatives:

1. Providing hoods above the doors in an attempt to capture emission gases, which are then diverted to some form of emission control device. Such a

technique is frequently ineffective, especially under windy conditions, because the releases from the door are not readily captured within the ducts.

2. Extensive and careful design of seals around the doors to prevent emissions. This alternative was selected by the U. S. Steel Corporation.

Removal of coke from the coke battery can be accomplished by using various techniques. It can be accomplished by merely pushing the coke into an open car which is rapidly transferred to the quench tower to reduce the coke temperature and thus prevent its consumption. This technique has been modified to include a hood above the car which captures the gases, which can then be ducted to some form of emission control device. Neither of these techniques was selected by U. S. Steel because the open car obviously permits excessive emissions. The open car plus the hood arrangement requires extreme care to insure that the safety of personnel working in the vicinity of the coke ovens is not jeopardized.

A more effective technique than either of these includes utilization of a single spot car and an associated emission control or gas cleaning car. At the present time, the only established emission control technique used on a gas cleaning car is wet scrubbing. This not only removes particulates, but also some hydrocarbon emissions by condensing the gases. Future technology may permit the use of baghouses instead of wet scrubber systems. Nevertheless, at this point the state of the art requires that wet scrubber systems be employed. A modification of this technique which was not selected by U. S. Steel for this coke battery would position the gas cleaning facilities at a fixed location and employ a vacuum system after moving the spot car to the oven which is ready to be pushed. This technique would be comparable to the spot car and gas cleaning car which is employed by U. S. Steel Corporation.

After the coke has been discharged to the spot loading car, it is transferred to quench towers for cooling. Quench towers may be either direct or offset. U. S. Steel Corporation has selected 90 degree off-set towers which aid in particulate removal and baffles which serve as partial demisters. Dry quench towers may be employed, but at the present time, difficulties with regard to maintenance and economy, as well as power requirements preclude their use on this coke battery. After quenching, the coke is screened and crushed. Emissions from this operation are controlled employing a baghouse instead of a precipitator or scrubber. It is preferable to reduce the moisture content of the coke as much as possible prior to its being added to the blast furnace and each of these controlled technologies are approximately equivalent. Therefore, baghouses were selected. At the end of this operation, the coke is transferred to the blast furnace silo. Covered conveyor belts are employed for this operation. An alternative transfer mechanism would be to place the coke directly in railroad cars.

6.6.2. Emission Control Alternatives for the New Blast Furnace

Coke, pellets and sinter, as well as quantities of other materials are transferred to the blast furnace by conveyor belts and stored in silos. Screening occurs prior to injection of properly sized materials to the blast furnace and produces emissions which are controlled. Wet scrubber systems, precipitators or baghouses could be employed. Scrubbers were not selected because of the addition of moisture which would require dewatering facilities and additional energy requirements. Baghouses were selected because they were equivalent technology to other particulate emission control techniques. The material captured by the baghouse and fines from a screening operation were all transferred to a silo. A transfer from the silo to the transportation vehicle is also controlled using water sprays for dust suppression. The properly sized material is transferred from the silos to the collection belt which is a final process prior to injection into the blast furnace. Belts handling sinter pellets and coke receive emission control through the same baghouse previously described for the screening operation. Therefore, alternatives described under that technique apply here as well.

6.6.3. Alternative Emission Control for the Q-BOP Furnace

The main exhaust hood from the Q-BOP furnace will be controlled employing a wet scrubber system and a flare. The alternatives for emission control of the main exhaust hood would be evaporative cooling followed by either a baghouse or a precipitator. The scrubber system is equivalent emission control and precludes the need for the evaporative cooling system prior to other controls, i.e., either baghouse or precipitator. Flare control is the only effective procedure for the conversion of carbon monoxide. During the period of time in which the Q-BOP is turned down, a 30 ft wide by 3 ft deep hood with continuous exhaust through a bag collector recovers a majority of the emissions. Either scrubbers or precipitators might be employed. However, considering this additional water usage and power requirements, bag collectors were determined to be most effective. Hot metal transfer processes also are exhausted through the same baghouse.

7. MITIGATIVE MEASURES

CHAPTER 7

MEASURES TO MITIGATE ADVERSE ENVIRONMENTAL IMPACTS

7.1. CONSTRUCTION IMPACTS

Temporary adverse impacts to air and water quality will result from construction of the new No. 8 Blast Furnace.

Clearing, grubbing, and earthmoving can result in the creation of a local dust problem. Truck traffic, which is anticipated to involve 15 percent of the materials required for construction, will generate additional dust. Roads were watered to mitigate impacts resulting from dust generation. Due to a policy of road paving, slagging, or oiling, and the remoteness of the construction site from any public area, the possibility of dust problems off-site is seen as minimal.

Dams were built to control drilling mud runoff. Stormwater drainage from the construction site will be handled by the plant-wide drainage system. It will be concentrated by pre-existing equipment and given primary treatment to minimize the effect on Opossum Creek.

7.2. OPERATIONAL IMPACTS

7.2.1. Air Quality

The following summary presents those emission control devices and process improvements which will be implemented to mitigate adverse impacts to air quality as a result of operation of Blast Furnace No. 8. These emission controls and process improvements are discussed in detail in Chapters 3 and 4 and alternative controls for air emissions are discussed in Chapter 6.

No. 8 Blast Furnace

1. Material handling - Six separate baghouses with separate fans.
2. Unloading and transferring - Liquid type dust suppression system.
3. Clean gas flare stack - With twin burner heads to control pressure in blast furnace gas distribution main.
4. Dustcatcher, reverse flow type - Large particles drop out due to sudden change in direction and decreased velocity.
5. Venturi scrubbers - For cleaning and cooling blast furnace gas.
6. Seal valves above and below top hopper - Two hoppers used alternately and pressurized with nitrogen.

In addition, the following emission controls and process improvements will be implemented to mitigate adverse impacts to air quality as a result of operation of the third Q-BOP and the No. 2 Coke Battery:

Third Q BOP

1. Drop-out doors - Large particles are allowed to drop out of gas cleaning system.
2. Venturi scrubbers - Gas cleaning and cooling.
3. Flare stack - To burn CO in gas before releasing to atmosphere.
4. Furnace enclosure - To capture emissions during blow.
5. Secondary hood - To capture emissions during turndown, charging, etc.

6. Charging doors - Equipped with air seals and water seals to prevent dust escape.
7. South mixer - Fume control system.

No. 2 Coke Battery

1. Coke and coal preparation - The following units are equipped with baghouses:
   - Three 10,000 - ton silos
   - Pulverizer building
   - Mixer
   - 100-ton bin
   - Secondary pulverizer
   - Coke transfer station
   - Belts A26A and A26B
2. Wet scrubber - Premetering bin.
3. Quench tower and baffle system.
4. Venturi scrubbers - Preheaters, clean exhaust gas.
5. Pushing controls - One spot quench car with venturi.
6. Improved charging cars.
7. Improved doors.

In general, the entire modernization program, including the construction of No. 8 Blast Furnace, the third Q-BOP, and Coke Battery No. 2, constitutes the replacement of existing facilities having high air emissions in an attempt to mitigate adverse air impacts.

7.2.2. Water Quality

Adverse impacts to water quality as a result of operation of Blast Furnace No. 8 will be mitigated by the implementation of a wastewater management system which utilizes modification and optimization of processes and existing treatment facilities and is discussed in Chapter 6. Also, the shutting down of facilities at Ensley Works will mitigate adverse impacts to the water quality of Village Creek.

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APPENDIX A

U. S. ENVIRONMENTAL PROTECTION AGENCY LETTER, APRIL 15, 1976, to U. S. STEEL CORPORATION

APPENDIX A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
1421 PEACHTREE ST., N. E.
ATLANTA, GEORGIA 30309

4AEW:WHC

APR 15 1976

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. James L. Hamilton, III
United States Steel Corporation
600 Grant Street
Pittsburgh, Pennsylvania 15230

Dear Mr. Hamilton:

As a result of various meetings and discussions with my staff I have made the following determinations relative to the discharge to the navigable waters of the United States from your Fairfield, Alabama plant expansion:

BLAST FURNACE

1. Construction of this facility was not in progress as of February 19, 1974.

2. This facility falls within the Iron and Steel industrial category.

3. New Source Performance Standards for this industrial category were proposed in the Federal Register on February 19, 1974.

4. There is a New Source Performance Standard within this category which can reasonably be considered applicable to the facility.

5. The expansion is of sufficient magnitude that it can reasonably be expected to have sufficient flexibility to achieve the applicable New Source Performance Standards.

As a result of these determinations I have concluded that because this expansion has the flexibility to achieve applicable New Source Performance Standards and construction of it did not begin prior to the New Source Performance Standards proposal date, the expanded portion of this facility is a new source. Therefore, in accordance with Section 511(c)(1) of the Federal Water Pollution Control Act, as amended (33 USC 1311), I have ruled that issuance of an NPDES permit to this facility is subject to all provisions of the National Environmental Policy Act of 1969 (83 Stat. 852).

RECEIVED
UNITED STATES STEEL CORPORATION
APR 19 1976
ENVIRONMENTAL CONTROL

QBOP UNIT AND COKE OVENS

1. Construction of this facility was not in progress as of February 19, 1974.

2. This facility falls within the Iron and Steel industrial category.

3. New Source Performance Standards for this industrial category were proposed in the Federal Register on February 19, 1974.

4. There is a New Source Performance Standard within this category which can reasonably be considered applicable to this facility.

5. This expansion is not of sufficient magnitude that it can reasonably be expected to have sufficient flexibility to achieve the applicable New Source Performance Standards.

As a result of these determinations I have concluded that because this expansion lacks the flexibility to achieve applicable New Source Performance Standards, the expanded portion of this facility is an existing source. Therefore, in accordance with Section 511(c)(1) of the Federal Water Pollution Control Act, as amended (33 USC 1311), I have ruled that issuance of an NPDES permit to this facility is not subject to any provisions of the National Environmental Policy Act of 1969 (83 Stat. 852).

You may submit a request for an adjudicatory hearing and/or legal decision within twenty (20) days of the receipt of this letter. The request and two copies thereof must be submitted to the Regional Hearing Clerk, Environmental Protection Agency, 1421 Peachtree Street, N.E., Atlanta, Georgia 30309. The submission of the request will be within the time period if mailed by Certified Mail before the 20th day. The request must:

1. State the name and address of the person making such request;

2. Include an agreement by the requestor to be subject to examination and cross-examination and to make any employee or consultant of such requestor or other person represented by the requestor available for examination and cross-examination at the expense of such requestor or such other person upon the request of the Presiding Officer, on his own motion, or on the motion of any party;

3. State with particularity the reasons for the request; and

4. State with particularity the issues proposed to be considered at the hearing.

Additional information on adjudicatory hearings and legal decisions is found at Title 40, Code of Federal Regulations, Section 125.36, 39, *Federal Register* 27081.

If you have further questions concerning this matter, please contact Mr. William H. Cloward of our Water Enforcement Branch at 404/526-2017.

Sincerely yours,

for John A. Little, Deputy
Jack E. Ravan
Regional Administrator

cc: Mr. James W. Warr
Alabama WIC

APPENDIX B

DRAFT NPDES PERMIT
U. S. STEEL CORPORATION
FAIRFIELD, ALABAMA

Permit No. AL 0003646
Application No. AL 076 OYM 3 000610

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

1. In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

United States Steel Corporation

is authorized to discharge from a facility located at

United States Steel Corporation
Fairfield District Works
P. O. Box 599
Fairfield, Alabama 35064

to receiving waters named

Discharge Serial Nos. 002 thru 009 enter Village Creek
Discharge Serial Nos. 010 thru 027 enter Opossum Creek
Discharge Serial No. 029 enters Valley Creek

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

2. This permit shall become effective on

3. This permit and the authorization to discharge shall expire at midnight,

4. Signed this day of

Regional Administrator

EPA Form 3320-4 (10-73)

MONITORING AND REPORTING

5. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

6. *Reporting*

Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on . Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
WATER ENFORCEMENT BRANCH
345 COURTLAND STREET, NE
ATLANTA, GEORGIA 30308

AL Water Improve. Comm.
State Ofc Bldg.
Montgomery, AL 36130

7. *Definitions*

a. The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

b. The "daily maximum" discharge means the total discharge by weight during any calendar day.

8. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

9. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

10. *Additional Monitoring by Permittee*

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

11. *Records Retention*

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

MANAGEMENT REQUIREMENTS

12. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated or detected new or different discharges of pollutants must be reported to the Regional Administrator. Following such report, the permit may be modified to specify and limit any pollutants not previously limited.

13. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

14. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate at optimum efficiency all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

15. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

16. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

17. *Removed Substances*

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

18. *Power Failures*

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

RESPONSIBILITIES

19. *Right of Entry*

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and /or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

20. *Transfer of Ownership or Control*

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

21. *Availability of Reports*

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

22. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

23. *Toxic Pollutants*
If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(A) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in the permit, and the Agency seeks to revise or modify the permit in accordance with the toxic effluent standard or prohibition, the permittee shall have notice and opportunity for hearing, with right of appeal, on the method of application of the toxic standard or prohibition if such application requires the use of discretion, judgement, or calculation by the permitting Agency. This provision is subject to the attached agreement.

24. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. This provision is subject to the attached agreement.

25. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

26. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

27. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights.

28. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

29. Other Requirements

This permit shall be subject to an agreement between United States Steel Corporation and the U. S. Environmental Protection Agency attached hereto.

a. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that calendar day.

b. The "daily maximum" concentration means the daily determination of concentration for any calendar day.

c. "Weighted by flow value" means the summation of each sample concentration times its respective flow in convenient units divided by the total flow.

d. For the purpose of this permit, a calendar day is defined as any consecutive 24-hour period.

e. For discharge serial numbers 010-027 from the Fairfield Works, all effluent limitations, except temperature, pH and dissolved oxygen, shall based upon "net daily loadings or concentrations," which are defined as net difference between the product of inlet volume times inlet concentra times a volume-to-weight conversion factor of 8.34, and the product of discharge volume times discharge concentration times the same 8.34 facto or the net difference between inlet and outlet concentrations.

30. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 002 ; Blast Furnace (Ensley Works)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	—	—	—	—	Once/Week	Instantaneous
Temperature, °C(°F)	--	--	--	35(95)	Once/Week	Grab
Ammonia-Nitrogen	214(472)	643(1417)	--	--	Once/Week	Composite
*Cyanide	--	-0-	--	--	Once/Week	Composite
Phenols	6.8(15)	20.9(46)	—	—	Once/Week	Composite
TSS	--	--	41 mg/1	67 mg/1	Once/Week	Composite

*This limit shall become effective on January 1, 1982. An interim effluent limitation of 46 Kg/day(100 lb/day) daily maximum shall be effective from the effective date of the permit thru December 31, 1978, and an interim final effluent limitation of 23 Kg/day(50 lb/day) daily maximum shall be effective from January 1, 1979, thru December 31, 1981.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once/week with a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

2 · During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 003-009; Ensley Mills

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)				
	Daily Avg	Daily Max	Daily Avg	Daily Max		Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—		Once/Week	Instantaneous
Temperature °C(°F)	--	--	--	35(95)		Once/Week	Grab
TSS	--	--	50 mg/l	100 mg/l	*	Once/Week	Composite
Oil & Grease	--	--	18 mg/l	30 mg/l	*	Once/Week	Grab
Iron	--	--	5 mg/l	10 mg/l	*	Once/Week	Composite
Zinc	--	--	1 mg/l	2 mg/l	*	Once/Week	Composite

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once/week with a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

*Concentration discharge limitations are combined flow weighted averages.

3. During the period beginning on the effective date of this permit and lasting through June 30, 1977, the permittee is authorized to discharge from outfall(s) serial number(s) 010-027, Fairfield Works.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	Continuous	Recorder
Temperature °C(°F)	—	—	—	35(95)	Continuous	Recorder
Ammonia-Nitrogen	—	789(1740)	—	—	Once/Week	24-Hour Composite
Cyanide	—	23(50)	—	—	Once/Week	24-Hour Composite
Phenols	—	15.8(35)	—	—	Once/Week	24-Hour Composite
TSS	1800(4000)	3510(7300)	—	—	Once/Week	24-Hour Composite
Oil & Grease	291(640)	631(1391)	—	—	Once/Week	Grab
T.D. Iron	136(300)	272(600)	—	—	Once/Week	24-Hour Composite
COD	5761(12690)	9568(21074)	—	—	Once/Week	24-Hour Composite
Total Chromium	4.5(10)	13.5(30)	—	—	Once/Week	24-Hour Composite
Total Zinc	41(90)	74(163)	—	—	Once/Week	24-Hour Composite
Tin	70(155)	140(310)	—	—	Once/Week	24-Hour Composite
Fluoride	202(446)	320(705)	—	—	Once/Week	24-Hour Composite

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once/week with a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the facility already established and defined as the Opossum Creek Monitoring Station.

A weekly average D.O. concentration of 5.0 mg/l shall be maintained in the discharge. This parameter shall be monitored five times per week using a grab sample. After a period of one year the monitoring frequency may be modified based upon an evaluation of the data.

Proposed Modification

4. During the period beginning July 1, 1977, and lasting through the term of the permit, the permittee is authorized to discharge from outfall(s) serial number(s) 010-027; Fairfield Works.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	Continuous	Recorder
Temperature ^{o}C (^{o}F)	--	--	--	35(95)	Continuous	Recorder
Ammonia-Nitrogen	--	860(1896)	--	--	Once/Week	24-Hour Composite
Cyanide	--	24.5(54)	--	--	Once/Week	24-Hour Composite
Phenols	--	19.5(43)	--	--	Once/Week	24-Hour Composite
TSS	1930(4255)	3828(8440)	--	--	Once/Week	24-Hour Composite
Total Zinc	16.3(36)	32.7(72)	--	--	Once/Week	24-Hour Composite
Oil & Grease	354(780)	744(1641)	--	--	Once/Week	24-Hour Composite
T. D. Iron	136(300)	272(600)	--	--	Once/Week	Grab
COD	5761(12690)	9568(21074)	--	--	Once/Week	24-Hour Composite
Total Chromium	4.5(10)	13.5(30)	--	--	Once/Week	24-Hour Composite
Tin	70(155)	140(310)	--	--	Once/Week	24-Hour Composite
Fluoride	323(713)	577(1271)	--	--	Once/Week	24-Hour Composite

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once/week with grab samples.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the facility already established and defined as the Opossum Creek Monitoring Station.

A weekly average D.O. concentration of 5.0 mg/l and a daily minimum of 4.0 mg/l shall be maintained in the discharge. This parameter shall be monitored five times per week using a grab sample. After a period of one year, the monitoring frequency may be modified based upon an evaluation of the data.

5. During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 029A and 029 (Sintering Plant).

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
DSN 029A - Sanitary Wastewaters: (Effective July 1, 1977)						
Flow—m^3/Day (MGD)	—	—	—	—	Once/Month	Instantaneous
Fecal Coliform	--	--	200/100ml	400/100ml	Once/Month	Grab
BOD	--	--	30 mg/1	45 mg/1	Once/Month	24-Hour Composite
DSN 029 - Process and Sanitary:						
Flow-m^3/Day(MGD)	--	--	--	--	Once/Week	Instantaneous
Temperature °C(°F)	--	--	--	35(95)	Once/Week	Grab
TSS	--	--	40 mg/1	60 mg/1	Once/Week	24-Hour Composite
Oil & Grease	--	--	10 mg/1	20 mg/1	Once/Week	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.5 standard units and shall be monitored at 029 once/week with grab samples. This requirement will become effective on July 1, 1977.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

6. The following limits shall be used to determine compliance with discharge numbers 010-027 during periods of rainfall or rainfall drainage. In the event the discharge of any wastewater from discharges 010-027 exceeds the parameters set out on pages 11 thru 16 of 21 by reason of rainfall or rainfall drainage, the Company must show compliance with this permit by proving that the performance values so established in this section are being met at each such treatment system.*

Effluent Characteristic	Discharge Limitations kg/day (lbs/day) Daily Avg	 Daily Max (Gross)	 Other Units (Specify) Daily Min.	 Daily Max	Monitoring Requirements Measurement Frequency	 Sample Type
A. Tin Mill						
Flow—m^3/Day (MGD)	—	—	—	—	**	Instantaneous
Oil & Grease	--	197(435)	--	--	**	Grab
TSS	--	978(2157)	--	--	**	24-Hour Composite
COD	--	4385(9658)	--	--	**	24-Hour Composite
Conductivity, µmhos	--	--	--	2539	**	Grab
pH, std. units	--	--	6.0	10.0	**	Grab
B. Coke Works						
Flow-m^3/Day (MGD)	--	--	--	--	**	Instantaneous
COD	--	1761(3879)	--	--	**	24-Hour Composite
Phenols	--	2.3(5)	--	--	**	24-Hour Composite
Cyanide	--	14(30)	--	--	**	24-Hour Composite
Ammonia-Nitrogen	--	196(432)	--	--	**	24-Hour Composite
pH, std. units	--	—	6.0	9.0	**	Grab

*Rainy days will be determined by rainfall that is greater than or equal to 0.1".

**On sampled days affected by rainfall or rainfall drainage.

6. Continued

	Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
		kg/day (lbs/day)		Other Units (Specify)			
		Daily Avg	Daily Max (Gross)	Daily Min.	Daily Max	Measurement Frequency	Sample Type
C.	Wire Mill						
	Flow-m^3/Day(MGD)	—	—	—	—	**	Instantaneous
	TSS	—	86(189)	—	—	**	24-Hour Composite
	Conductivity, μmhos	—	—	—	2068	**	Grab
	pH, std. units	—	—	6.0	12.0	**	Grab
D.1.	From effective date of this permit until July 1, 1977, Q-BOP's (2)						
	Flow-m^3/Day(MGD)	—	—	—	—	**	Instantaneous
	TSS	—	204(449)	—	—	**	24-Hour Composite
	Conductivity, μmhos	—	—	—	745	**	Grab
	pH, std. units	—	—	6.0	9.0	**	Grab
D.2.	From July 1, 1977, untilthe expiration date of this permit, Q-BOP's (3)						
	Flow-m^3/Day(MGD)	—	—	—	—	**	Instantaneous
	TSS	—	306(674)	—	—	**	24-Hour Composite
	Conductivity, μmhos	—	—	—	745	**	Grab
	pH, std. units	—	—	6.0	9.0	**	Grab

**On sampled days affected by rainfall or rainfall drainage.

Proposed Modification

6. Continued

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg (Gross)	Daily Max (Gross)	Daily Min.	Daily Max	Measurement Frequency	Sample Type
E. 1. Blast Furnaces (No. 5, 6, & 7)						
Flow-m^3/Day(MGD)	--	--	--	--	**	Instantaneous
TSS	--	304(670)	---	--	**	24-Hour Composite
pH, std. units	--	--	6.0	9.0	**	Grab
E. 2. From January 1, 1978, until the expiration date of this permit, Blast Furnace (No. 8)						
Flow-m^3/Day(MGD)	--	--	--	--	On Days of Rain	Instantaneous
TSS	59(130)	177(390)	--	--	On Days of Rain	24-Hour Composite
CN-A	.6(1.3)	1.8(4.0)	--	--	On Days of Rain	Grab
Phenol	1.2(2.6)	3.6(8.0)	--	--	On Days of Rain	Grab
NH_3-N	24(52)	71(156)	--	--	On Days of Rain	24-Hour Composite
Sulfide	.7(1.6)	2.3(5)	--	--	On Days of Rain	24-Hour Composite
Flouride	47(104)	142(312)	--	--	On Days of Rain	24-Hour Composite
pH. std. units	--	--	6.0	9.0	On Days of Rain	Grab

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

**On sampled days affected by rainfall or rainfall drainage.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

I. Discharge Serial No. 002: Permittee shall achieve zero discharge of cyanide by January 1, 1982. An acceptable compliance schedule shall be submitted to EPA and AWIC on/or before January 1, 1981, to include steps to be taken to achieve zero discharge of cyanide by January 1, 1982. The following compliance schedule shall apply:

Effective date of permit-Achieve interim cyanide effluent limitation of 46 kg/day(100 lbs/day) daily maximum.

September 1, 1977 - Submit Progress Report.

July 1, 1978 - Submit Progress Report.

January 1, 1979-Achieve interim final cyanide effluent limitations of 23 kg/day(50 lbs/day) daily maximum and begin preliminary engineering.

April 1, 1979 - Submit Progress Report.

January 1, 1980-Submit Progress Report.

September 1, 1980 - Submit Progress Report.

July 1, 1981 - Submit Progress Report.

January 1, 1982-Achieve zero discharge of cyanide.

II. Discharge Serial Nos. 003-009: There shall be no sanitary discharges from Ensley Mills after June 30, 1977.

III. Discharge Serial Nos. 010-027: Attain final zinc (total) limitations by July 1, 1977.

IV. Discharge Serial No. 029: Attain pH limitations by July 1, 1977.

V. Discharge Serial No. 029A: Attain BOD and fecal coliform limitations by July 1, 1977.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.